Household credit, risk premia and consumption*

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Abstract

I study how risk premia transmit to aggregate consumption. While prior work emphasizes links from capital prices to consumption, I argue for a distinct channel: household credit conditions. I build a quantitative macro model with capital, risky household debt and shocks to risk premia. Analytically, I show that cross-sectional consumption data distinguish between the effects of risk premia through household credit and capital prices. Empirically, consumption growth comoves most strongly with risk premia for households with consumer credit. Quantitatively, the model replicates the aggregate and cross-sectional consumption responses to changes in risk premia. Changes in household credit conditions account for most high-frequency consumption volatility. Macroprudential stabilization of household credit dampens the short-run effects of risk premia on consumption, while stabilizing capital markets smooths consumption at longer horizons.

JEL Codes: E44, G12, G51

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1 Introduction

Changes in risk premia are widely viewed as an important source of business cycle fluctuations (Cochrane (2011), Gilchrist and Zakrajšek (2012), Pflueger, Siriwardane, and Sunderam (2020)). The dominant view in the literature is that shocks to risk premia reach consumption through firms and the price of capital. When capital prices are high, investment rises (Gourio (2012), Brunnermeier and Sannikov (2014)), potentially raising incomes and consumption (Basu and Bundick (2017), Kekre and Lenel (2022)). Further, high capital prices mean that capital owners are wealthier and consume more as a result (Caballero and Simsek (2020), Chodorow-Reich, Nenov, and Simsek (2021)). However, changes in household borrowing also predict consumption fluctuations (Mian, Sufi, and Verner (2017), Mian and Sufi (2018)), and recent work in heterogeneous agent macroeconomics emphasizes households with low liquid wealth as being particularly important for aggregate consumption dynamics (Kaplan and Violante (2018), Aguiar, Bils, and Boar (2025)). These strands of research suggest that household credit conditions might be quantitatively important in the transmission of risk premia to aggregate consumption.

In this paper, I argue that at high frequencies, shocks to risk premia propagate to aggregate consumption primarily through household credit supply, rather than through capital prices. Reductions in risk premia cause borrowing spreads for households to fall, raising consumption for borrowers. Using microdata on household balance sheets and consumption, I find support for this mechanism in the cross-section of households. In a quantitative macro model where heterogeneous households invest through a financial intermediary, the credit supply channel accounts for the majority of high-frequency consumption fluctuations, while at longer horizons, the capital channels play a larger role. Household borrowing crowds out capital investment, meaning that macroprudential policy in household credit markets alone does little to stabilize consumption, while combining interventions in household credit and capital markets dampens consumption fluctuations at short and longer horizons.

Empirically, I find that household credit supply is a key channel through which financial sector risk appetite is transmitted to household consumption. Using data from the Consumer Expenditure Survey, I find that consumption growth comoves with risk premia most strongly for households with consumer credit. In contrast, after controlling for debt holdings, my analysis does not find strong evidence in support of significant wealth effects from capital holdings or a broad-based increase in consumption driven by short-run general equilibrium effects. I also do not find a differential exposure for mortgage borrowers, the focus of most existing work on household credit and consumption.

Motivated by these empirical findings, I build a New Keynesian macro-finance model with

risky household debt contracts. Households differ in their time preferences and invest in risky capital and risky household debt through financial intermediaries. Increased intermediary risk appetite affects aggregate consumption and output through three channels: first, an investment boom raises aggregate demand and output, which feeds back into consumption through capital rents and wages; second, households holding the existing capital stock raise consumption because their wealth increases as a result of higher capital prices; third, a credit boom raises consumption for households borrowing against their future income. I calibrate the model to match microdata on household portfolios and income, as well as a number of business cycle and asset pricing moments. Quantitatively, the model implies that the household credit supply channel accounts for most of the short-term rise in consumption following an increase in financial sector risk appetite.

I first derive testable implications from the model to guide the empirical work. To do so, I study a simplified, two-period version of the model. In the model, I show that time-series aggregates do not distinguish between these three channels: all three channels predict a loosening in financial conditions accompanied by a boom in consumption. The theory shows, however, that the cross-section of households is able to distinguish between the three channels. The investment channel predicts a broad increase in consumption: because the channel operates through general equilibrium, all households see an increase in their incomes and consumption when risk premia fall. The other two channels are identified by the relative responses of households holding capital and borrowing through debt. The additional increase in consumption of stockholders relative to households without capital or debt provides bounds on the size of the capital wealth channel, and the additional increase in consumption of households borrowing through debt to fund consumption provides bounds on the size of the credit supply channel. I use this result to organize the empirical work, which provides support for the credit supply channel, absent from benchmark macro-finance models.

I begin my empirical analysis by studying the aggregate dynamic comovement between risk premia, debt and real activity, as well as credit conditions for households. I run local projections of consumption, debt, investment, credit card lending standards and limits, and personal loan spreads on the Gilchrist and Zakrajšek (2012) excess bond premium. Consistent with the predictions of my model, a fall in the excess bond premium is associated with an aggregate demand boom through both consumption and investment, as well as an easing in household credit conditions and an increase in borrowing.

These time series estimates alone, however, cannot distinguish between the relative contributions of the three channels. To address this, I next study consumption growth in the Consumer Expenditure Survey (CEX), splitting the sample based on whether households

report having securities or consumer credit. Households with consumer credit but no securities have consumption growth that is strongly negatively correlated with innovations in the Gilchrist and Zakrajšek (2012) excess bond premium. In contrast, the comovement for households with securities is small and not statistically significant. Households with neither securities nor consumer credit also do not show a significant correlation with innovations in the excess bond premium, suggesting a limited role for the investment channel within a short time horizon.

The results are robust to comparisons within income, age, occupation, education, race and sex groups, and to a regression using only food spending, suggesting that the results are not driven by differences in cyclical income or relative-price exposures. The group interactions with real wages and salaries, or with the unemployment rate, do not reproduce the ranking across groups, suggesting that the estimates are not picking up differences in consumption responses to changes in income. When securities, consumer credit and mortgages enter jointly, the mortgage interaction is close to zero, in contrast to the literature emphasizing housing collateral in the propagation of household credit supply expansions. Consistent with this finding, my local projections do not show an economically significant response of house prices or mortgage spreads, in contrast to the findings for consumer credit. The consumer credit results are also robust to other measures of the price of risk, namely the Bekaert, Engstrom, and Xu (2022) risk aversion measure and the excess CAPE yield, the earnings yield on the cyclically adjusted price-to-earnings ratio of Campbell and Shiller (1988) less the ten-year real Treasury yield.

I then calibrate a quantitative version of my model to match household portfolios, wealth and income in the Survey of Consumer Finances (SCF), as well as a number of business cycle and asset pricing moments. I identify the debtors in my model as households with consumer credit in the SCF. These households are around 61 percent of the population and account for a similar share of labor income. Investors are households without consumer credit, but with direct holdings of equities. These households are around 15 percent of the population, and richer on average, accounting for 27 percent of labor income. Quantitatively, the model reproduces the consumption and investment impulse responses to an innovation in the excess bond premium, as well as the cross-sectional differences in comovements between consumption growth and the excess bond premium across investors and debtors. The model also replicates the failure of the aggregate consumption Euler equation, in part because debtors are on an Euler equation for an interest rate that is only weakly correlated with safe rates due to the time-varying bond premium.

I use the model to quantify the contributions of each of the three channels to changes in aggregate consumption following a financial shock. To do so, I introduce tax wedges

to shut down the credit supply and capital channels in turn, allowing me to estimate the marginal contribution of each channel. I find that credit supply is the largest channel within the first year following an increase in financial sector risk-bearing capacity, accounting for 75 percent of the cumulative consumption response. In contrast, the capital channels are stronger at longer horizons. In the short run, general equilibrium feedback from higher investment and consumption boosts incomes and consumption, but wealth effects from the capital channels weigh on consumption. Investors consume more as capital prices rise, but risk-free interest rates also rise, suppressing debtor consumption. As the credit boom fades, however, consumption remains high, supported by persistently high incomes and an eventual fall in risk-free rates.

The model implies that changes in risk premia, rather than productivity, are the main source of business cycle fluctuations. A forecast error variance decomposition attributes a majority of consumption, investment and output fluctuations to risk premia, except at very high frequencies where investment is slow to respond. I invert the model to recover the implied shocks to productivity and risk premia from 1994 to 2019 based on the time series of GDP and the excess bond premium. The model attributes both recessions in the sample, the early 2000s recession and the Great Financial Crisis, to large increases in risk premia. Based on the inversion, the model is able to explain most of the variation in consumption and investment over the sample.

Finally, I use the model to study business cycle stabilization policy. I model countercyclical macroprudential policy through financial taxes on household credit and capital. Taxes on household credit dampen the short-run effects of risk premia on consumption. However, household credit taxes do little to reduce overall consumption volatility, because household credit crowds out capital, amplifying investment volatility. In contrast, while capital taxes are ineffective in stabilizing the initial fall in consumption after an increase in risk premia, the recovery from the shock is much faster, and consumption overall becomes less volatile. Combining both taxes dampens short-run volatility while preserving the faster recovery from shocks. As a fiscal policy benchmark, deficit-financed transfers crowd out capital in the same way as taxes on household credit, but provide less support for consumption due to low marginal propensities to consume.

Related literature A large literature studies the propagation of risk premia in business cycle models.[1] As in Brunnermeier and Sannikov (2014), He and Krishnamurthy (2019) and Elenev, Landvoigt, and Van Nieuwerburgh (2021), risk premia in my model depend on financial intermediaries' risk-bearing capacity. Following Basu and Bundick (2017), Caballero

[1] Tallarini (2000), Gourio (2012), Ilut and Schneider (2014), Hall (2017), Di Tella and Hall (2022).

and Simsek (2020) and Kekre and Lenel (2022), nominal rigidities in my model constrain the risk-free rate, so that increases in risk premia lead to demand recessions. In this literature, risk premia are priced on capital claims, reaching consumption through investment, capital prices or precautionary saving. I add a risk premium on household debt, an instrument relevant for a larger share of households, and show that changes in household credit premia account for most of the high-frequency variation in consumption. Like Caballero, Caravello, and Simsek (2024) and Caballero and Simsek (2026), I study business cycle stabilization that directly targets fluctuations in risk premia. I show that, because household credit crowds out capital market financing, interventions in household credit and capital markets are complementary.

Credit spreads play a central role in financial accelerator models, following Bernanke and Gertler (1989), Kiyotaki and Moore (1997), Bernanke, Gertler, and Gilchrist (1999), Gertler and Kiyotaki (2010) and Christiano, Motto, and Rostagno (2014). A number of papers adapt this mechanism to study the household sector, mostly through mortgage collateral following Iacoviello (2005).[2] Most closely related to my paper, Cúrdia and Woodford (2016) and Faccini, Lee, Luetticke, Ravn, and Renkin (2026) study time-varying spreads between household borrowing and deposit rates in New Keynesian models; FLLR+ (2026) additionally provide complementary empirical evidence based on Danish data. In contrast to the financial frictions literature, my model focuses on risk premia on risky loans, rather than spreads arising from agency frictions. As a result, my model is able to speak to co-movements between equity risk premia and household credit spreads. I also solve my model globally, rather than considering linearizations around a steady state, allowing me to study risk premia and the full, nonlinear dynamics of my model.

More broadly, this paper contributes to the literature on heterogeneity in macroeconomic models.[3] While most of this literature generates heterogeneity in marginal propensities to consume from liquidity constraints, as in Kaplan and Violante (2014) and Kaplan, Moll, and Violante (2018), agents in my model differ in their marginal propensities to consume and borrow due to preference heterogeneity, as suggested by Aguiar, Bils, and Boar (2025) and Lewis, Melcangi, and Pilossoph (2026). Like De Graeve, Dossche, Emiris, Sneessens, and Wouters (2010), Kekre and Lenel (2022) and Melcangi and Sterk (2025), I study heterogeneity in households' risky-asset exposure, but additionally consider consumer credit market participation. In doing so, I build on Eggertsson and Krugman (2012), Korinek and Simsek (2016) and Guerrieri and Lorenzoni (2017), who study one-time shocks to borrowing

[2]See also Gerali, Neri, Sessa, and Signoretti (2010), Iacoviello and Neri (2010), Justiniano, Primiceri, and Tambalotti (2015, 2019).

[3]For surveys, see Kaplan and Violante (2022) and Auclert, Rognlie, and Straub (2025).

limits. I extend this work to recurring changes in the price of consumer credit driven by aggregate risk premia, consistent with evidence from Lee and Maxted (2026) that borrowers are typically far from their credit limits.

A number of papers empirically study the link between household credit supply and consumption. This literature finds that in the aggregate, household credit growth comoves with consumption (Ludvigson (1999), Mian, Sufi, and Verner (2017, 2020)), and that at the micro level consumption responds to changes in credit supply (Gross and Souleles (2002), Benmelech, Meisenzahl, and Ramcharan (2017), Aydin (2022), Garber, Mian, Ponticelli, and Sufi (2024)). I develop a structural model consistent with this evidence, and contribute new evidence that the comovement of consumption with financial conditions is strongest among consumer credit borrowers, in contrast to a large literature focusing on housing and mortgages (Mian and Sufi (2011), Mian, Rao, and Sufi (2013), Mian and Sufi (2014), Foulis, Hazell, Mian, and Tracey (2026)).

Beginning with Hansen and Singleton (1982, 1983), a long literature documents the failure of consumption-based asset pricing with aggregate consumption. In response, the limited participation literature shows that the consumption of stockholders is more consistent with asset returns (Mankiw and Zeldes (1991), Attanasio, Banks, and Tanner (2002), Vissing-Jørgensen (2002), Brav, Constantinides, and Geczy (2002)). I show that the consumption of households with consumer credit also tracks risk premia. In my model, these households' Euler equation holds for their borrowing rate rather than stock returns or safe rates, reconciling the failure of the aggregate Euler equation with evidence that aggregate consumption is strongly predicted by risky asset prices (Gilchrist and Zakrajšek (2012), Di Tella, Hébert, Kurlat, and Wang (2026)). Quantitatively, the credit supply channel drives the short-run comovement of consumption with risk premia, presenting a challenge for consumption-based theories of asset pricing relying on comovements at a quarterly or monthly frequency (e.g., Di Tella, Hébert, Kurlat, and Wang (2026)). However, in my model the investment and capital wealth channels are much stronger at lower frequencies, consistent with evidence that consumption risk in equity returns appears over long horizons (Parker and Julliard (2005), Malloy, Moskowitz, and Vissing-Jørgensen (2009)).

Outline In section 2, I outline my model. In section 3, I use a simplified environment to analytically characterize the key mechanisms through which risk premia affect consumption in the model and derive empirical tests for the transmission channels. In section 4, I study the relationship between consumption and risk premia in the time series and the cross-section of households. In section 5, I calibrate the model, quantify the channels through which risk premia affect consumption and study stabilization policy. Section 6 concludes.

2 Model

In this section, I outline a New Keynesian model with two household types, capital and risky household debt, where assets are priced by a financial intermediary.

2.1 Environment

Time is discrete. The economy is populated by a unit measure of households.

Households Households consume a good with price P_t and supply labor. There are two household types, indexed i for "investors" and d for "debtors". Households differ in their time preferences: investors are more patient than debtors, with discount factors $\beta^i > \beta^d$. There are measures λ^i and λ^d of each household type. Each household consists of a continuum of members indexed by $h \in [0, 1]$, who fully share consumption. Each member h of household type j specializes in a labor variety h and works l^j_{th} hours at nominal wage W_{th}.[4] Households maximize

$$\mathbb{E}_t \sum_{s=0}^{\infty} (\beta^j)^s u(c^j_{t+s}, l^j_{t+s}), \tag{1}$$

where l^j_t is an index of hours across varieties,

$$l^j_t = \left(\int_0^1 (l^j_{th})^{1+1/\nu} dh \right)^{\frac{1}{1+1/\nu}},$$

and $u(c^j_t, l^j_t)$ is flow utility from consumption and labor supply,

$$u(c^j_t, l^j_t) = \frac{1}{1 - 1/\psi} (c^j_t \Phi(l^j_t))^{1-1/\psi}. \tag{2}$$

The disutility of labor $\Phi(l^j_t)$ is given by

$$\Phi(l^j_t) = \left(1 + (1/\psi - 1)\bar{\nu} \frac{1}{1 + 1/\nu} (l^j_t)^{1+1/\nu} \right)^{\frac{1/\psi}{1-1/\psi}}. \tag{3}$$

Financial markets Households save and borrow through financial intermediaries: they can purchase intermediary shares s_t, or borrow from intermediaries through risky bonds b_t. Shares in the intermediary have a price of 1 at time t and return R^I_{t+1} at $t + 1$. There are

[4] Following Kekre and Lenel (2022), I assume that households can trade claims to their labor income with other households of the same type, and that the claims of dying households pass to newborns of the same type, so that policies are homogeneous of degree one in wealth and the model permits aggregation into representative households of each type.

three underlying assets: capital, risky bonds and risk-free bonds. Capital trades at a nominal price Q_t^k, pays dividends Π_{t+1} for each unit purchased at time t and depreciates at a rate δ. Following Barro (2006), each period there is a probability p^d that the economy is hit by a rare disaster and a fraction $1 - \exp(\varphi^z)$ of capital is destroyed. The real return on capital is

$$R_{t+1}^k = \exp(\varphi_{t+1}) \frac{\Pi_{t+1} + (1-\delta)Q_{t+1}^k}{Q_t^k} \frac{P_t}{P_{t+1}},$$

where $\varphi_{t+1} = 0$ with probability $(1 - p^d)$ and φ^z with probability p^d. Risk-free bonds pay the nominal interest rate i_t and are in zero net supply. The real return on risk-free bonds is

$$R_{t+1}^f = (1 + i_t)P_t/P_{t+1}.$$

Finally, a risky bond trades at nominal price Q_t^b at t and makes a nominal payment of 1 at $t + 1$. Household members are subject to idiosyncratic employment shocks. As described in appendix A.1, household members default on their debt obligations if the idiosyncratic shock exceeds a threshold that depends on aggregate productivity growth $\Delta \log z_t$. Idiosyncratic default risk is diversified, so the share of risky bonds repaid each period is

$$\text{repay}_t = \frac{1}{1 + \exp\left(-\kappa(\Delta \log z_t - \bar{z}^b)\right)}.$$

In a disaster, a share φ^b of loans default, in which case $\text{repay}_t = 1 - \varphi^b$. Defaulted loans are collected in full from the member's household by debt collectors, so borrowers always repay. The proceeds are paid to households in proportion to their holdings of intermediary shares, which they take as given, so default generates no aggregate transfer between borrowers and lenders.[5] For borrowers the return on borrowing is

$$R_{t+1}^{b,0} = \frac{1}{Q_t^b} \frac{P_t}{P_{t+1}}, \tag{4}$$

while intermediaries receive the return

$$R_{t+1}^b = \text{repay}_{t+1} R_{t+1}^{b,0}. \tag{5}$$

In appendix A.3, I show that Q_t^b can be interpreted as the average price on a credit surface, in the spirit of Geanakoplos (1997), where borrowing rates depend on credit scores, so that changes in Q_t^b capture changes in both lending standards and spreads.

[5] This modeling device is designed to capture the idea that consumer borrowing rates are risky from the perspective of lenders, but not from the perspective of borrowers.

Financial intermediaries Intermediaries live for one period and are subject to stochastic investment opportunities, leading to time-varying leverage. In appendix A.4, I show that, to second order, this is equivalent to assuming that intermediaries maximize expected constant relative risk aversion utility over returns with time-varying risk aversion γ_t,

$$\mathbb{E}_t \left[\frac{1}{1-\gamma_t} \left(R^I_{t+1} \right)^{1-\gamma_t} \right]. \tag{6}$$

Intermediary returns are

$$R^I_{t+1} = \omega^k_t R^k_{t+1} + \omega^b_t R^b_{t+1} + (1 - \omega^k_t - \omega^b_t) R^f_{t+1},$$

where ω^k_t and ω^b_t are the portfolio shares in capital and risky bonds. Intermediary risk aversion γ_t follows an AR(1) process,

$$\gamma_t = (1-\rho^\gamma)\bar{\gamma} + \rho^\gamma \gamma_{t-1} + \sigma_\gamma \epsilon^\gamma_t, \tag{7}$$

where ϵ^γ_t is i.i.d. standard normal. Since changes in risk aversion are induced by shocks to leverage, I will refer to changes in γ_t as changes in risk-bearing capacity, in the spirit of the intermediary asset pricing models of He and Krishnamurthy (2013) and Brunnermeier and Sannikov (2014).

While I model intermediary risk aversion as following an exogenous process, in practice, risk premia are likely at least partly endogenous. The asset pricing literature provides a plethora of explanations for time-varying risk premia, such as disaster risk (Barro (2006), Wachter (2013)), idiosyncratic risk (Constantinides and Duffie (1996)), financial intermediary balance sheets (He and Krishnamurthy (2013), Brunnermeier and Sannikov (2014)), consumption habits (Constantinides (1990), Campbell and Cochrane (1999)), and behavioral biases (Barberis, Shleifer, and Vishny (1998), Barberis, Huang, and Santos (2001)). I model an exogenous process for risk premia because it allows me to separate the propagation of risk premia from the propagation of the drivers of risk premia. An exogenous process also allows the model to be agnostic on the causes of time-varying risk premia; the results in section 3 characterize the effects of a change in risk premia regardless of its source.

Budget constraint Capital holdings, direct or through intermediary shares, are subject to a lower bound, a constant share $\bar{k}$ of each household's wealth (including human wealth). This lower bound captures illiquid capital holdings, such as retirement accounts, to match the data on household portfolios in section 5. Households cannot hold capital directly beyond

this requirement. Capital holdings satisfy the lower bound

$$q_t^k k_t^j + \omega_t^k s_t^j \geq \bar{k} \left(R_t^k q_{t-1}^k k_{t-1}^j + R_t^{b,0} q_{t-1}^b b_{t-1}^j + R_t^I s_{t-1}^j + q_t^{n,j} \right), \tag{8}$$

where human wealth $q_t^{n,j}$ is the value of current and future labor income discounted at the household's stochastic discount factor, $q_t^k = Q_t^k / P_t$ is the real price of capital and $q_t^b = Q_t^b / P_t$ is the real price of the risky bond. The household budget constraint is

$$c_t^j + q_t^k k_t^j + q_t^b b_t^j + s_t^j = R_t^k q_{t-1}^k k_{t-1}^j + R_t^{b,0} q_{t-1}^b b_{t-1}^j + R_t^I s_{t-1}^j + \int_0^1 \frac{W_{th}}{P_t} l_{th}^j \, dh + T_t^j, \tag{9}$$

where T_t^j are real lump-sum transfers, including the proceeds of debt collection.

Production There is a representative firm producing output y_t using labor l_t and capital k_{t-1} with a Cobb–Douglas production function with log productivity z_t,

$$y_t = (\exp(z_t) l_t)^{1-\alpha} (k_{t-1} \exp(\varphi_t))^{\alpha}.$$

Aggregate productivity follows a random walk in logs,

$$z_t = z_{t-1} + \sigma_z \epsilon_t^z + \varphi_t,$$

where ϵ_t^z is i.i.d. standard normal and φ_t is the disaster shock, so a disaster also permanently lowers productivity. The firm produces new capital goods x_t, subject to adjustment costs. The cost of producing new capital is $(k_t / (k_{t-1} \exp(\varphi_t)))^{\chi^k}$. The firm hires labor l_t at price W_t and earns profits

$$\Pi_t k_{t-1} \exp(\varphi_t) = P_t y_t - W_t l_t + \left(Q_t^k - P_t \left(\frac{k_t}{k_{t-1} \exp(\varphi_t)} \right)^{\chi^k} \right) x_t, \tag{10}$$

taking capital growth k_t / k_{t-1} as given. The price of the consumption good, P_t, is flexible. Capital accumulates according to

$$k_t = (1 - \delta)(k_{t-1} \exp(\varphi_t)) + x_t. \tag{11}$$

The equilibrium real price of capital is

$$q_t^k = \left(\frac{k_t}{k_{t-1} \exp(\varphi_t)} \right)^{\chi^k}. \tag{12}$$

Labor market The labor input l_t is an aggregate of differentiated types of labor indexed by $h \in [0,1]$

$$l_t = \left(\int_0^1 l_{th}^{1-\frac{1}{\varepsilon}} dh \right)^{\frac{\varepsilon}{\varepsilon-1}}.$$

Cost minimization for the firm implies that demand for labor variety h is

$$l_{th} = \left(\frac{W_{th}}{W_t} \right)^{-\varepsilon} l_t, \tag{13}$$

where W_t is the aggregate wage index

$$W_t = \left(\int_0^1 W_{th}^{1-\varepsilon} dh \right)^{\frac{1}{1-\varepsilon}},$$

and $w_t = W_t / P_t$ is the real wage. A union for each variety h sets the nominal wage W_{th} to maximize the utilitarian welfare of its members, subject to labor demand (13) and Rotemberg (1982) adjustment costs

$$\frac{\chi^W}{2} \left(\frac{W_{th}}{W_{t-1,h} \exp(\varphi_t)} - 1 \right)^2 W_t l_t, \tag{14}$$

scaled by the aggregate wage bill. Adjustment costs are paid to the government and rebated to households in proportion to their labor income. Wages are indexed to disasters, so adjustment costs do not apply to the productivity lost in a disaster. The union for variety h requires type-j households to provide a fixed share $\bar{l}^j$ of the demand for variety h, $\lambda^j l_{th}^j = \bar{l}^j l_{th}$. The union optimization problem and the resulting wage Phillips curve are described in appendix A.2.

Monetary policy Monetary policy follows a Taylor rule,

$$1 + i_t = (1 + \bar{i}) \left(P_t / P_{t-1} \right)^{\phi}. \tag{15}$$

Wealth distribution Each period a fraction ξ of households die and are replaced by newborn households of the same type. Newborn investors are endowed with a share $\bar{\eta}$ of the wealth of dying agents, with the residual accruing to newborn debtors. The law of motion for the share of wealth held by investors, η_t, is

$$\eta_{t+1} = (1-\xi) \frac{\lambda^i \left[R_{t+1}^k q_t^k k_t^i + R_{t+1}^{b,0} q_t^b b_t^i + \left(R_{t+1}^I + \left(R_{t+1}^{b,0} - R_{t+1}^b \right) \omega_t^b \right) s_t^i \right]}{R_{t+1}^k q_t^k k_t} + \xi \bar{\eta}. \tag{16}$$

Equilibrium Given the state variables $\{\eta_t, w_{t-1}, k_{t-1}, \gamma_t\}$, and stochastic processes for ϵ_t^z, φ_t and ϵ_t^γ, an equilibrium is a set of prices and policies such that households maximize utility (1) subject to their budget (9), capital (8) and trading constraints, the intermediary chooses a portfolio to maximize (6), the firm maximizes profits (10), the unions set wages as described in appendix A.2, the monetary authority follows its Taylor rule (15), the goods market clears,

$$\lambda^i c_t^i + \lambda^d c_t^d + \left(\frac{k_t}{k_{t-1}\exp(\varphi_t)}\right)^{\chi^k} x_t = y_t, \tag{17}$$

the labor market for each variety clears,

$$\lambda^i l_{th}^i + \lambda^d l_{th}^d = l_{th}, \tag{18}$$

the capital market clears,

$$Q_t^k\left(\lambda^i k_t^i + \lambda^d k_t^d\right) + \omega_t^k P_t\left(\lambda^i s_t^i + \lambda^d s_t^d\right) = Q_t^k k_t, \tag{19}$$

the risky bond market clears,

$$Q_t^b\left(\lambda^i b_t^i + \lambda^d b_t^d\right) + \omega_t^b P_t\left(\lambda^i s_t^i + \lambda^d s_t^d\right) = 0, \tag{20}$$

the risk-free bond market clears,

$$\omega_t^k + \omega_t^b = 1, \tag{21}$$

and the investor wealth share follows (16).

3 Analytical insights

In this section, I illustrate the key mechanisms in the model and derive testable implications to guide the empirical analysis. To do so, I study a simplified, two-period version of the model in section 2. The assumptions in this section are relaxed in the quantitative model in section 5. Proofs are in appendix A.5.

3.1 Simplifying assumptions

There are two periods, $t \in \{0, 1\}$, with initial conditions at $t = -1$, no deaths ($\xi = 0$) and no lower bound on capital holdings ($\bar{k} = 0$). Households have log utility ($\psi = 1$). Investors hold the initial capital stock and supply no labor ($\bar{l}^i = 0$), and no household holds nominal claims at $t = -1$. The nominal wage is fixed at its $t = -1$ level ($\chi^W \to \infty$), so

output at $t = 0$ is demand determined. At $t = 1$, debtors supply one unit of labor at a fixed real wage $\bar{w}$ and output is $y_1 = \exp(\sigma_z \epsilon_1^z) k_0^\alpha + \bar{w}$. The monetary authority does not respond to the shock ($\phi = 0$) and commits to $P_1 = P_0$. The share of risky bonds repaid at $t = 1$, repay_1, is independent of productivity, with $\sigma_b^2 \equiv \text{Var}(\log \text{repay}_1)$, and households take as given the debt-collection proceeds per intermediary share. There is no disaster risk ($p^d = 0$). The parameters are such that, in equilibrium, only debtors borrow, only investors hold intermediary shares, and investment is positive (proposition 4 in appendix A.5).

3.2 Portfolio choice, risk premia and consumption

The intermediary's first-order conditions imply

$$\mathbb{E}_0 \left[\left(R_1^I \right)^{-\gamma_0} \left(R_1^k - R_1^f \right) \right] = 0, \tag{22}$$

$$\mathbb{E}_0 \left[\left(R_1^I \right)^{-\gamma_0} \left(R_1^b - R_1^f \right) \right] = 0. \tag{23}$$

Taking a second-order approximation to the Euler equations, the optimal intermediary portfolio shares for the two risky assets take a mean-variance form,

$$\omega^b \approx \frac{1}{\gamma_0} \frac{\text{rp}_0^b}{\sigma_b^2}, \qquad \text{rp}_0^b \equiv \mathbb{E} \log(R_1^b) - \log(R_1^f) + \frac{1}{2}\sigma_b^2, \tag{24}$$

$$\omega^k \approx \frac{1}{\gamma_0} \frac{\text{rp}_0^k}{\sigma_z^2}, \qquad \text{rp}_0^k \equiv \mathbb{E} \log(R_1^k) - \log(R_1^f) + \frac{1}{2}\sigma_z^2, \tag{25}$$

where rp_0^b and rp_0^k denote the risk premia on the risky bond and capital. Combining the optimal portfolio choices with market clearing in the asset markets, we can derive expressions for the risk premia on the risky bond and capital. Let a_0^i and a_0^d denote investor and debtor savings in period 0. In equilibrium, debtors borrow, so $a_0^d < 0$ and $a_0^i > 0$.

Proposition 1. *The risk premia on the risky bond and capital are*

$$\text{rp}_0^b = \sigma_b^2 \gamma_0 \frac{-a_0^d}{a_0^i}, \tag{26}$$

$$\text{rp}_0^k = \sigma_z^2 \gamma_0 \frac{a_0^i + a_0^d}{a_0^i}. \tag{27}$$

Both risk premia are increasing in the risk aversion shock, $d\text{rp}_0^b / d\epsilon_0^\gamma > 0$ and $d\text{rp}_0^k / d\epsilon_0^\gamma > 0$.

Changes in risk premia affect consumption directly through changes in lifetime wealth, and indirectly through changes in income. The optimal consumption policies of the two

household types are

$$c_0^d = \frac{1}{1+\beta^d}\left(w_0 l_0^d + Q_0^b \bar{w}\right), \tag{28}$$

$$c_0^i = \frac{1}{1+\beta^i}\left(\Pi_0/P_0 + (1-\delta)q_0^k\right) k_{-1}. \tag{29}$$

The optimal consumption policies depend on the bond and capital prices, so that changes in risk premia directly affect consumption. Investment is affected by risk premia through the expected return on capital, which is

$$\mathbb{E}\log(R_1^k) = -(1-\alpha+\chi^k)\log(k_0) + \chi^k \log(k_{-1}). \tag{30}$$

Equation (30) shows that the expected return on capital is decreasing in investment, so a decrease in the capital risk premium raises investment. Aggregating these channels, we can derive the response of aggregate consumption to changes in risk premia.

Proposition 2. *In response to a risk aversion shock, aggregate consumption* $C \equiv c_0^i + c_0^d$ *changes by*

$$\frac{dC}{d\epsilon_0^\gamma} = \frac{1}{1-\text{mpc}}\left(\mathcal{C}^x + \mathcal{C}^k + \mathcal{C}^b\right), \tag{31}$$

where $\text{mpc} = \alpha\text{mpc}^i + (1-\alpha)\text{mpc}^d$ *is the income-weighted aggregate marginal propensity to consume with* $\text{mpc}^i = \frac{1}{1+\beta^i}$ *and* $\text{mpc}^d = \frac{1}{1+\beta^d}$*, and*

$$\mathcal{C}^x \equiv \text{mpc}\,\left((1+\chi^k)q_0^k k_0 - \chi^k(1-\delta)q_0^k k_{-1}\right)\frac{d\log k_0}{d\epsilon_0^\gamma} \qquad \textit{(investment channel)},$$

$$\mathcal{C}^k \equiv \text{mpc}^i\,\chi^k(1-\delta)q_0^k k_{-1}\frac{d\log k_0}{d\epsilon_0^\gamma} \qquad \textit{(capital wealth channel)},$$

$$\mathcal{C}^b \equiv \text{mpc}^d\,Q_0^b\bar{w}\frac{d\log Q_0^b}{d\epsilon_0^\gamma} \qquad \textit{(credit supply channel)},$$

where

$$\frac{d\log k_0}{d\epsilon_0^\gamma} = -\frac{1}{1-\alpha+\chi^k}\frac{d\text{rp}_0^k}{d\epsilon_0^\gamma}, \qquad \frac{d\log Q_0^b}{d\epsilon_0^\gamma} = -\frac{d\text{rp}_0^b}{d\epsilon_0^\gamma}.$$

Output changes by

$$\frac{dy_0}{d\epsilon_0^\gamma} = \frac{dC}{d\epsilon_0^\gamma} + q_0^k\left((1+\chi^k)k_0 - \chi^k(1-\delta)k_{-1}\right)\frac{d\log k_0}{d\epsilon_0^\gamma}.$$

A decrease in risk premia leads to an increase in consumption through three channels. First, lower risk premia lead to higher investment, which stimulates aggregate demand, leading to higher consumption through higher wage and capital income. Second, the investment

boom raises capital prices, leading to an increase in consumption for capital owners through the capital wealth effect. Finally, lower risk premia allow debtors to borrow more because the price of risky bonds rises, leading to higher debtor consumption. All three channels are amplified by the Keynesian multiplier $1/(1 - \text{mpc})$. Propositions 1 and 2 show that all three channels provide the same empirical prediction for the time series of risk premia and consumption: in all cases, low risk premia should be associated with a consumption boom. Next, we can further distinguish between channels by deriving predictions for the cross-section of households.

Proposition 3. *Suppose there is also a measure-zero set of households, indexed n, who hold neither risky asset, save only in the risk-free bond, and earn labor income only at $t = 0$, supplying a fixed share of labor demand, so that*

$$c_0^n = \frac{1}{1+\beta^n} w_0 l_0^n, \qquad w_0 l_0^n \propto y_0. \tag{32}$$

(i) The consumption response of debtors is a share of the response of output plus the credit supply channel of proposition 2, per unit of debtor consumption. The response of investors is a share of the response of output plus the capital wealth channel, per unit of investor consumption,

$$\frac{d \log c_0^d}{d\epsilon_0^\gamma} = (1-\theta^b)\frac{d \log y_0}{d\epsilon_0^\gamma} + \frac{\mathcal{C}^b}{c_0^d}, \tag{33}$$

$$\frac{d \log c_0^i}{d\epsilon_0^\gamma} = (1-\theta^k)\frac{d \log y_0}{d\epsilon_0^\gamma} + \frac{\mathcal{C}^k}{c_0^i}, \tag{34}$$

$$\frac{d \log c_0^n}{d\epsilon_0^\gamma} = \frac{d \log y_0}{d\epsilon_0^\gamma}, \tag{35}$$

where $\theta^b \equiv Q_0^b \bar{w}/(w_0 l_0^d + Q_0^b \bar{w})$ and $\theta^k \equiv (1-\delta) q_0^k k_{-1}/(\alpha y_0 + (1-\delta) q_0^k k_{-1})$ are the shares of debtor and investor wealth valued at Q_0^b and q_0^k.

(ii) Let $\Delta^j \equiv d \log c_0^j/d\epsilon_0^\gamma - d \log c_0^n/d\epsilon_0^\gamma$ be the consumption response of type $j \in \{d, i\}$ relative to type n. Then

$$\frac{\mathcal{C}^b}{c_0^d} = \Delta^d + \theta^b \frac{d \log y_0}{d\epsilon_0^\gamma}, \qquad \frac{\mathcal{C}^k}{c_0^i} = \Delta^i + \theta^k \frac{d \log y_0}{d\epsilon_0^\gamma}, \tag{36}$$

so each channel lies between Δ^j and $\Delta^j + d \log y_0/d\epsilon_0^\gamma$.

Proposition 3 says that cross-sectional data on household consumption and balance sheets are informative about the relative sizes of the three channels. The general equilibrium ef-

fects of a change in risk premia, including the investment channel, raise factor income for all households. The consumption response of households without capital or debt identifies these general equilibrium effects, since these households do not have any balance sheet exposure to the price of risk. The capital wealth channel can then be bounded by the relative response of households holding capital. These households see an increase in income, but also consume more in response to an increase in their wealth. Looking at the difference between their consumption response and that of the base group without capital or debt bounds this additional capital wealth effect. Similarly, households with debt see an increase in their income, but also respond to easier credit conditions by raising borrowing. The difference between their consumption response and that of the base group provides bounds on the size of the credit supply channel. Since output falls when risk aversion rises, the second term in (36) is negative, so each channel is at least as negative as the relative response Δ^j. A fall in consumption relative to the base group is therefore a conservative estimate of the size of the channel. Section 4.2 will use this result to test the channels using data from the Consumer Expenditure Survey.

4 Empirical evidence

In this section, I study the aggregate dynamic comovements between risk premia, real activity and credit conditions, providing evidence consistent with proposition 2. I then analyze the relationship between consumption growth and risk premia for different groups of households to test the strength of each propagation channel, following proposition 3.

Propositions 2 and 3 describe responses to a shock to intermediary risk aversion γ_0. In proposition 1, the capital and bond risk premia are the product of γ_0, the price of risk, and the quantity of risk the intermediary bears. I measure the price of risk with the Gilchrist and Zakrajšek (2012) excess bond premium (EBP), which is an index of US nonfinancial corporate bond spreads residualized for firm-level default risk and bond characteristics. I treat innovations in the EBP as the empirical counterpart of ϵ_0^γ, up to scale.

4.1 Aggregate evidence

Data and empirical strategy I project real activity and credit conditions on the excess bond premium using local projections,

$$y_{t+h} = \alpha_h + \theta_h \text{EBP}_t + \sum_{l=1}^{p} \delta_{h,l}' w_{t-l} + \epsilon_{h,t}, \tag{37}$$

where y_t is my outcome of interest: log real per capita personal consumption expenditures on nondurables and services, excluding housing and education,[6] revolving consumer credit to trend GDP, log real per capita private nonresidential fixed investment, the two-year personal loan spread, and credit card lending standards and limits.[7] Trend nominal GDP is estimated using a Hodrick–Prescott filter with smoothing parameter $\lambda = 1600$. The EBP is a quarterly average of monthly values. The vector $w_{t-l} = (r_{t-l}, \text{EBP}_{t-l}, y_{t-l})$ contains my controls r_{t-l}, the EBP and the outcome variable at lag l. The controls r_{t-l} are nondurables and services inflation (excluding housing and education), the two-year Treasury yield and the ten-year–two-year Treasury term spread. I set $p = 4$ lags. This specification is equivalent to a Cholesky identification scheme with the EBP ordered first; the results are broadly unchanged when including contemporaneous controls. The impulse response of y_t at horizon h is given by $\hat{\theta}_h$. The data are quarterly from 1994 to 2025, matching the CEX sample described below, except for the SLOOS questions, which are only available from 1996 onward.

Results Figure 1 shows the impulse responses of the excess bond premium, consumption, revolving consumer credit to trend GDP and investment to a one-standard-deviation (0.3 percentage points) fall in the excess bond premium. A fall in the excess bond premium is associated with an increase in real consumption, revolving consumer credit and investment. This is consistent with the predictions of proposition 2 and with the dominant view that risk premia reach consumption through capital prices, but it does not help distinguish which channels are responsible for the increase in consumption. The impulse responses show a rise in investment, which could be raising incomes and consumption, as in the investment channel. Similarly, lower risk premia could be directly raising consumption through the wealth of households with claims on capital, as in the capital wealth channel. However, easing credit conditions for households could also be raising consumption. Figure 2 shows the impulse responses of credit card lending standards, credit limits and the personal loan spread to a one-standard-deviation fall in the excess bond premium. A reduction in the excess bond premium is associated with banks reporting an easing in lending standards and credit limits, and lower spreads on personal loans, consistent with the interpretation of

[6] Housing in the national accounts is mostly imputed rent on owner-occupied homes rather than household outlays. I exclude education for consistency with the CEX measure in section 4.2, where it mostly reflects large, infrequent tuition payments.

[7] I take my measures of lending standards and credit limits from the Federal Reserve's Senior Loan Officer Opinion Survey (SLOOS), which reports the net percentage of domestic banks tightening standards for credit card loans, and reducing credit limits, over the previous three months. I calculate the cumulative sum of each series, so the response at horizon h is the net percentage summed from t to $t + h$. The data series are diffusion indices, meaning that their cumulative sums cannot be interpreted as the changes in the level of lending standards or credit limits. The cumulative sums instead measure the net number of times banks tightened standards or reduced credit limits over the horizon of the impulse response, per 100 banks.

changes in the model's bond price Q_t^b as shifts in a credit surface (appendix A.3).

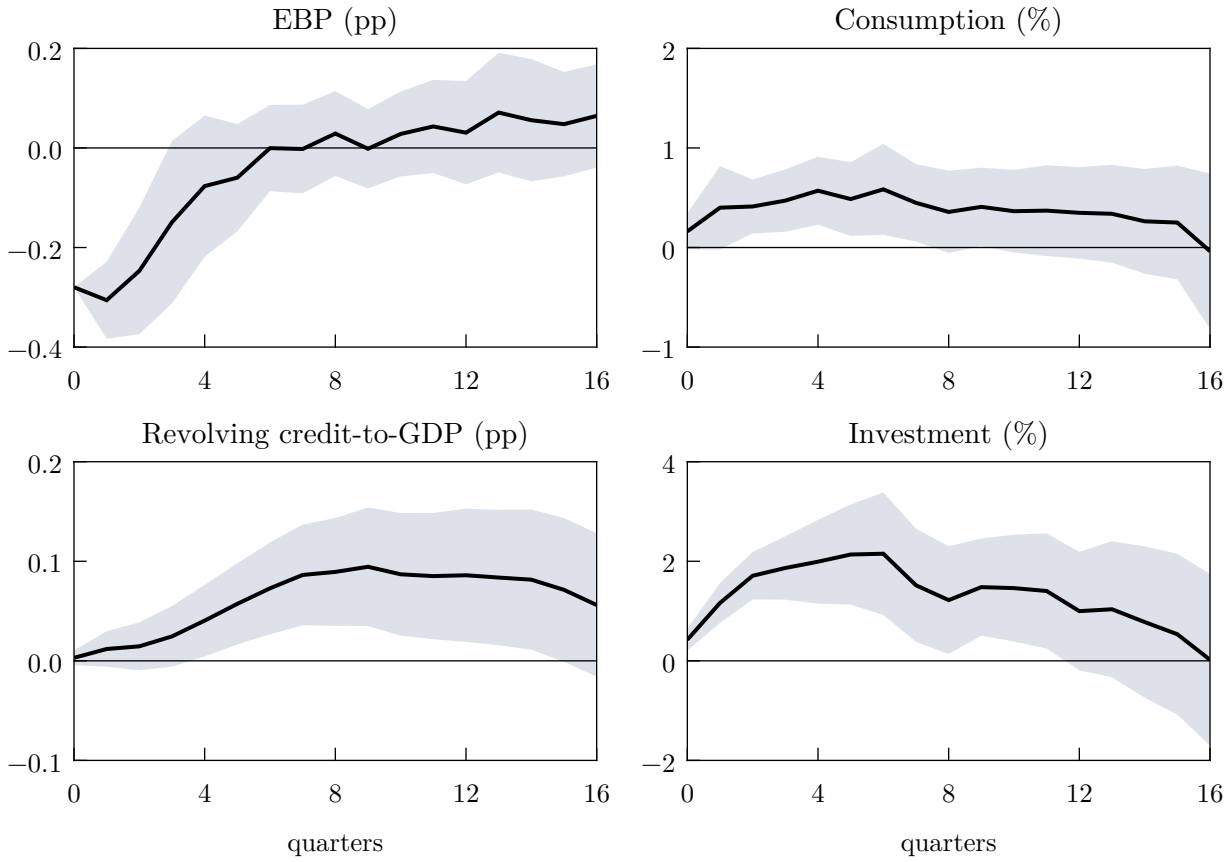


Figure 1: Impulse responses of activity and credit to a fall in the excess bond premium

Notes: Impulse responses estimated by local projection as described in equation (37). The shock is a one-standard-deviation fall in the Gilchrist and Zakrajšek (2012) excess bond premium. Consumption is log real per capita nondurables and services excluding education and housing. Revolving credit-to-GDP is total nominal revolving consumer credit divided by nominal trend GDP, calculated using a Hodrick–Prescott filter. Investment is log real per capita private nonresidential fixed investment. Shaded bands are 95 percent confidence intervals based on heteroskedasticity-robust standard errors (Montiel Olea and Plagborg-Møller (2021)).

4.2 Evidence from the Consumer Expenditure Survey

I now use cross-sectional data on consumption and balance sheets to test the size of the three channels, following proposition 3.

4.2.1 Data

Consumption data I use data from the Consumer Expenditure Survey (CEX), a household spending survey. The CEX surveys a rotating panel of households who are followed

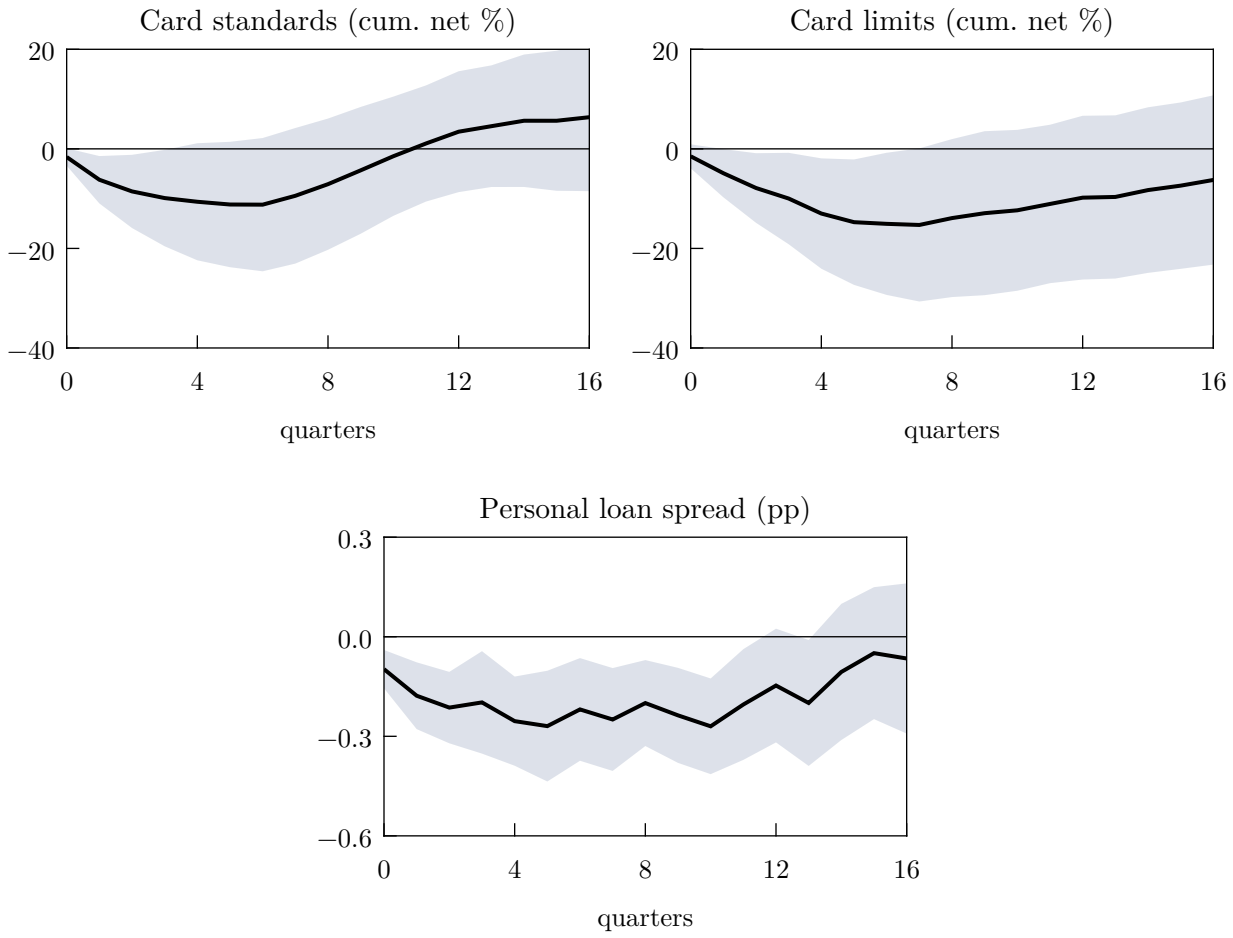


Figure 2: Impulse responses of credit conditions to a fall in the excess bond premium

Notes: Impulse responses estimated by local projection as described in equation (37). The shock is a one-standard-deviation fall in the Gilchrist and Zakrajšek (2012) excess bond premium. Credit card lending standards and limits are the cumulative net percentages of domestic banks tightening standards for credit card loans, and reducing credit limits, in the Federal Reserve's Senior Loan Officer Opinion Survey. The personal loan spread is the average 24-month personal loan rate at commercial banks minus the two-year Treasury yield. Shaded bands are 95 percent confidence intervals based on heteroskedasticity-robust standard errors (Montiel Olea and Plagborg-Møller (2021)).

for four consecutive quarters. Expenditures on detailed expenditure categories in the prior three months are recorded at each interview. From the four household interviews, I calculate semiannual growth in nondurable goods and services consumption and total consumption, including durables, at the household level. My estimation sample is monthly from January 1994 to March 2025. January 1994 is the first time that households are asked about revolving credit card debt.

I define nondurables and services consumption as the sum of food, alcohol, tobacco, gasoline and motor oil, apparel, reading, personal care, utilities, household operations, vehicle operating costs, fees and admissions, health, miscellaneous goods and services, and television, radio and sound equipment. As in section 4.1, I exclude shelter (the counterpart to housing in the PCE data) and education. Including education, which mostly reflects large, infrequent tuition payments, reduces precision without much effect on the point estimates. I also consider a broader measure of consumption including durables by adding vehicle purchases, household furnishings and equipment, and entertainment durables. I deflate nominal values by the CPI for nondurables, durables and services less rent of shelter.

In my baseline regressions, I split the sample of households on two margins: whether they report direct holdings of stocks, bonds or mutual funds ("securities"), and whether they report having consumer credit debt. Consumer credit is revolving credit card debt, vehicle loans, personal loans and other installment loans. Appendix B.2 provides further detail on the data and sample construction.

Risk premia My baseline measure of the price of risk is the Gilchrist and Zakrajšek (2012) excess bond premium. The consumer credit results are robust to alternative measures of the price of risk, namely the Bekaert, Engstrom, and Xu (2022) risk aversion index and the excess CAPE yield, the inverse of the Campbell and Shiller (1988) cyclically adjusted price-to-earnings ratio less the ten-year Treasury yield net of a ten-year trailing average of CPI inflation. Appendix B.3 reports these specifications.

4.2.2 Empirical strategy

Using the CEX data, I construct semiannual real consumption growth rates for each household i at month t as

$$\Delta \log c_t^i = 200 \times \left(\log \left(\sum_{k=0}^{5} c_{t-k}^i \right) - \log \left(\sum_{k=6}^{11} c_{t-k}^i \right) \right). \tag{38}$$

I estimate

$$\Delta \log c_t^i = \alpha^0 + \beta^0 \,\mathrm{EBP}_t + \gamma^0 \,\mathrm{EBP}_{t-6} + \sum_j \left(\alpha^j + \beta^j \,\mathrm{EBP}_t + \gamma^j \,\mathrm{EBP}_{t-6}\right) \mathbf{1}[i \in S^j] + \delta' X_t + \epsilon_t^i, \tag{39}$$

where EBP_t is the mean of the excess bond premium from $t-5$ to t; S^j is the set of households in group j, where $j = C$ for households with consumer credit only, $j = S$ for securities only and $j = CS$ for both; and X_t contains month-of-year dummies to address seasonality in the data. If EBP_t is an AR(1) at a six-month frequency, then controlling for EBP_{t-6} means that β^0 and $\beta^0 + \beta^j$ estimate the response of consumption growth for the base group and for group j to an AR(1) innovation in the excess bond premium, which maps to $d \log c_0^j / d\epsilon_0^\gamma$ in proposition 3.[8] The base group does not have exposure through consumer credit or securities, so their response β^0 identifies the general equilibrium effect $d \log y_0 / d\epsilon_0^\gamma$ in (35). Households with debt have an additional response from borrowing conditions (33), so the credit supply channel per unit of debtor consumption is between β^C and $\beta^C + \beta^0$ (36). Similarly, households with securities have an additional response through their wealth (34), so the capital wealth channel per unit of investor consumption is between β^S and $\beta^S + \beta^0$ (36). The group with both consumer credit and securities does not help distinguish between the credit supply and capital wealth channels, because any additional response could come from either channel.

There are three main threats to identification. First, the model underlying proposition 3 assumes that log income exposures are the same across households. If cyclical income exposures were instead correlated with portfolio differences, this would bias estimates of β^j. I address this by running a specification that adds occupation, income quintile, age group, education, race and sex by time fixed effects, so that households are compared with others that are similar on observable characteristics that are related to the cyclicality of income (Hoynes, Miller, and Schaller (2012), Guvenen, Schulhofer-Wohl, Song, and Yogo (2017), Patterson (2023)).

Second, even with the same income exposures, households could have different consumption responses to changes in income, as emphasized in the literature on heterogeneous agent New Keynesian models. If marginal propensities to consume out of income are correlated with portfolio differences, and income changes are important in the propagation of changes in risk premia, this would also bias estimates of β^j. I address this by separately adding real per capita wages and salaries and the unemployment rate, each interacted with the same group dummies. If differential responses to changes in risk premia reflect different responses

[8] Lagged consumption is predetermined before the realization of the EBP innovation, so the estimand is the same for both the growth and level of log consumption on the left-hand side.

to income changes, we would expect to see the same results from interactions with labor market variables.

Finally, households differ in their consumption baskets, and so it may be that cyclical differences in their consumption reflect different exposures to relative price changes. I address this by re-estimating the same specification on real food consumption alone. Food is the consumption category common across all households in the sample.

4.2.3 Results

Table 1 reports the estimates of equation (39) for nondurable consumption growth. Column (1) shows the baseline specification with no fixed effects. If all channels are active and strong, we would expect to see negative coefficients in all rows. The coefficient for the base group, households with no securities and no consumer credit, has a positive point estimate and is not statistically significantly different from zero. The coefficient for households with only securities is -1.0 and not statistically significant. In contrast, the coefficient for households with only consumer credit is negative and statistically significant. This group has annualized consumption growth that is 1.7 percentage points lower for each percentage point increase in the excess bond premium, relative to households holding neither position. The households with both consumer credit and securities also have a negative coefficient, but it is not significant in the baseline specification.

From the perspective of proposition 3, these results suggest relatively weak income effects (identified by the coefficient on the base group), and therefore a weak investment channel, at least within a short horizon. The coefficient on securities holders is smaller in magnitude than for consumer credit holders and imprecisely estimated, so the evidence for a capital wealth channel is weak. In contrast, the consumer-credit-only coefficient is statistically significant. A one-standard-deviation innovation in the six-month-average excess bond premium lowers this group's annualized consumption growth by 0.8 percentage points relative to the base group, about half of average aggregate consumption growth over the sample. This estimate provides evidence for a sizable credit supply channel per unit of debtor consumption.

Column (2) adds occupation, income quintile, age group, education, race and sex by time fixed effects, which absorb the base excess bond premium coefficient. The consumer credit groups still have negative coefficients, only slightly changed from the baseline, suggesting that the results are not driven by differences in cyclical income exposures. Column (3) re-estimates the baseline on food alone. The consumer-credit-only interaction is slightly larger in magnitude than in column (1) and remains significant, although the base group shows a negative and significant coefficient, providing some evidence for general equilibrium effects on incomes. Table 2 reports the same specifications for total consumption, which

adds durables. The estimates for the consumer credit groups are more negative, as expected given the inclusion of vehicle purchases, which are large and often credit-financed.

Table 3 adds real per capita wages and salaries interacted with the same groups, retaining the excess bond premium and its interactions as controls. The base row is positive, though not statistically significant. The interaction terms are small or negative, consistent with the results in the baseline not being driven by households responding differently to changes in income. The consumer-credit-only EBP interaction is little changed by including wages and salaries as a control.

Table 4 conducts the same exercise with the unemployment rate. The base group is negative and significant at the 1 percent level: an increase in unemployment is associated with lower consumption growth. The consumer-credit-only interaction has a coefficient close to zero, suggesting that this group's differential response to risk premia in the baseline does not reflect a differential response to an aggregate change in income. The other two groups have negative and statistically significant point estimates, and controlling for unemployment moves their excess bond premium interactions toward zero. The baseline point estimates for these groups may therefore partly reflect other cyclical factors. The consumer-credit-only EBP interaction, in contrast, is little changed by including the unemployment rate as a control.

	Nondurables and services		Food
	(1)	(2)	(3)
EBP	0.225 (0.774)	—	-1.831** (0.930)
Sec., no cons. credit × EBP	-1.001 (0.901)	-0.569 (0.755)	-0.169 (1.799)
Cons. credit, no sec. × EBP	-1.746*** (0.515)	-1.772*** (0.491)	-1.817** (0.718)
Cons. credit & sec. × EBP	-2.084 (1.271)	-2.159** (0.961)	0.187 (1.919)
Fixed effects	None	Demog. × date	None
Observations	122,407	122,407	122,407

Table 1: Nondurable consumption growth and the excess bond premium

Notes: Estimates of equation (39). The dependent variable is semiannual growth in real nondurable goods and services consumption in columns (1) and (2), and in real food spending in column (3), in annualized percentage points. Rows are the interaction of the six-month mean of the Gilchrist and Zakrajšek (2012) excess bond premium with a dummy for each household group and a constant. Each regression also includes the six-month lag of the six-month mean of the excess bond premium, with the same interactions, as well as month-of-year dummies. Column (2) adds occupation, income quintile, age group, education, race and sex × time fixed effects. Standard errors, in parentheses, are Driscoll and Kraay (1998) standard errors at an eleven-month lag length.
* p<0.1, ** p<0.05, *** p<0.01.

	Consumption	
	(1)	(2)
EBP	-0.137 (0.904)	—
Sec., no cons. credit × EBP	-0.454 (1.968)	-0.592 (2.256)
Cons. credit, no sec. × EBP	-2.207*** (0.763)	-2.965*** (1.068)
Cons. credit & sec. × EBP	-6.860*** (1.790)	-7.476*** (2.020)
Fixed effects	None	Demog. × date
Observations	119,304	119,304

Table 2: Total consumption growth and the excess bond premium

Notes: Estimates of equation (39). The dependent variable is semiannual growth in real total consumption, in annualized percentage points. Rows are the interaction of the six-month mean of the Gilchrist and Zakrajšek (2012) excess bond premium with a dummy for each household group and a constant. Each regression also includes the six-month lag of the six-month mean of the excess bond premium, with the same interactions, as well as month-of-year dummies. Column (2) adds occupation, income quintile, age group, education, race and sex × time fixed effects. Standard errors, in parentheses, are Driscoll and Kraay (1998) standard errors at an eleven-month lag length.
* p<0.1, ** p<0.05, *** p<0.01.

The role of mortgages and housing Prior work on household credit supply and consumption focuses largely on mortgages and house prices.[9] To test the relevance of mortgages in this context, table 5 enters securities, consumer credit and mortgages as overlapping dummies. The mortgage interactions in table 5 are close to zero and not statistically significant, suggesting that mortgage holders are not more exposed to changes in risk premia than other households on average. One reason for this may be that mortgages in the US are predominantly GSE-backed, and so likely less exposed to fluctuations in risk premia. Mortgages are also collateralized and have lower default rates than other forms of household debt. Figure 3 plots the responses of the 30-year mortgage spread and nominal house prices to a fall in the excess bond premium, following the same specification as in section 4.1. The mortgage spread falls modestly on impact and quickly reverses, becoming slightly positive after a year, in contrast to the consumer credit variables in section 4.1. House prices do not respond significantly, and the point estimates are negative in response to the fall in the EBP.

[9]For empirical work, see, for example, Mian and Sufi (2011) and Foulis, Hazell, Mian, and Tracey (2026), and for theoretical work see, for example, Iacoviello (2005) and Greenwald (2018).

	Nondurables and services		Food
	(1)	(2)	(3)
Wages	0.832 (0.541)	—	1.188* (0.613)
Sec., no cons. credit × Wages	-0.068 (0.741)	-0.156 (0.816)	0.726 (1.008)
Cons. credit, no sec. × Wages	0.177 (0.436)	0.218 (0.442)	0.107 (0.587)
Cons. credit & sec. × Wages	-0.645 (0.542)	-0.402 (0.625)	-0.806 (0.724)
EBP	0.714 (0.729)	—	-1.243 (0.943)
Sec., no cons. credit × EBP	-1.215 (1.005)	-0.755 (0.951)	0.156 (1.743)
Cons. credit, no sec. × EBP	-1.735*** (0.554)	-1.684*** (0.513)	-1.939** (0.758)
Cons. credit & sec. × EBP	-2.510* (1.332)	-2.296** (1.069)	-0.415 (1.975)
Fixed effects	None	Demog. × date	None
Observations	122,407	122,407	122,407

Table 3: Placebo: consumption growth and labor income

Notes: Estimates of equation (39), additionally including wages and salaries interacted with the same dummies as the excess bond premium. The dependent variable is semiannual growth in real nondurable goods and services consumption in columns (1) and (2), and in real food spending in column (3), in annualized percentage points. Rows are the six-month mean of log real per capita wages and salaries from the compensation of employees interacted with a dummy for each household group and a constant. Each regression also includes the six-month lag of the six-month mean of real wages and salaries, the six-month average of the excess bond premium and the six-month lag of the six-month average of the excess bond premium with the same interactions, as well as month-of-year dummies. Column (2) adds occupation, income quintile, age group, education, race and sex × time fixed effects. Standard errors, in parentheses, are Driscoll and Kraay (1998) standard errors at an eleven-month lag length.
* p<0.1, ** p<0.05, *** p<0.01.

	Nondurables and services		Food
	(1)	(2)	(3)
Unemployment	-2.283*** (0.431)	—	-2.886*** (0.621)
Sec., no cons. credit × Unemployment	-1.670*** (0.505)	-1.266** (0.576)	-0.591 (0.711)
Cons. credit, no sec. × Unemployment	-0.086 (0.466)	0.109 (0.501)	0.396 (0.623)
Cons. credit & sec. × Unemployment	-2.061** (0.837)	-1.878** (0.861)	-1.293* (0.768)
EBP	1.240 (0.762)	—	-0.938 (1.146)
Sec., no cons. credit × EBP	-0.402 (0.974)	-0.090 (0.896)	-0.003 (1.835)
Cons. credit, no sec. × EBP	-1.819*** (0.520)	-1.796*** (0.503)	-2.237*** (0.693)
Cons. credit & sec. × EBP	-1.563 (1.143)	-1.520* (0.905)	0.557 (1.949)
Fixed effects	None	Demog. × date	None
Observations	122,407	122,407	122,407

Table 4: Placebo: consumption growth and unemployment

Notes: Estimates of equation (39), additionally including the unemployment rate interacted with the same dummies as the excess bond premium. The dependent variable is semiannual growth in real nondurable goods and services consumption in columns (1) and (2), and in real food spending in column (3), in annualized percentage points. Rows are the interaction of the six-month mean of the unemployment rate with a dummy for each household group and a constant. Each regression also includes the six-month lag of the six-month mean of the unemployment rate, the six-month average of the excess bond premium and the six-month lag of the six-month average of the excess bond premium with the same interactions, as well as month-of-year dummies. Column (2) adds occupation, income quintile, age group, education, race and sex × time fixed effects. Standard errors, in parentheses, are Driscoll and Kraay (1998) standard errors at an eleven-month lag length.
* p<0.1, ** p<0.05, *** p<0.01.

	Nondurables and services		Food
	(1)	(2)	(3)
EBP	0.199 (0.781)	—	-1.808* (0.947)
Sec. × EBP	-0.536 (0.860)	-0.439 (0.770)	1.389 (1.378)
Consumer credit × EBP	-1.616*** (0.512)	-1.780*** (0.451)	-1.301* (0.663)
Mortgage × EBP	-0.114 (0.489)	0.108 (0.562)	-0.708 (0.513)
Fixed effects	None	Demog. × date	None
Observations	122,407	122,407	122,407

Table 5: Securities, consumer credit and mortgages entered jointly

Notes: Estimates of equation (39) with the household groups replaced by overlapping dummies for holding securities, consumer credit and a mortgage. The dependent variable is semiannual growth in real nondurable goods and services consumption in columns (1) and (2), and in real food spending in column (3), in annualized percentage points. The first three rows are the interaction of the six-month mean of the Gilchrist and Zakrajšek (2012) excess bond premium with each dummy. The last row is the coefficient on the excess bond premium. Each regression also includes the six-month lag of the six-month mean of the excess bond premium, with the same interactions, as well as month-of-year dummies. Column (2) adds occupation, income quintile, age group, education, race and sex × time fixed effects. Standard errors, in parentheses, are Driscoll and Kraay (1998) standard errors at an eleven-month lag length.
* p<0.1, ** p<0.05, *** p<0.01.

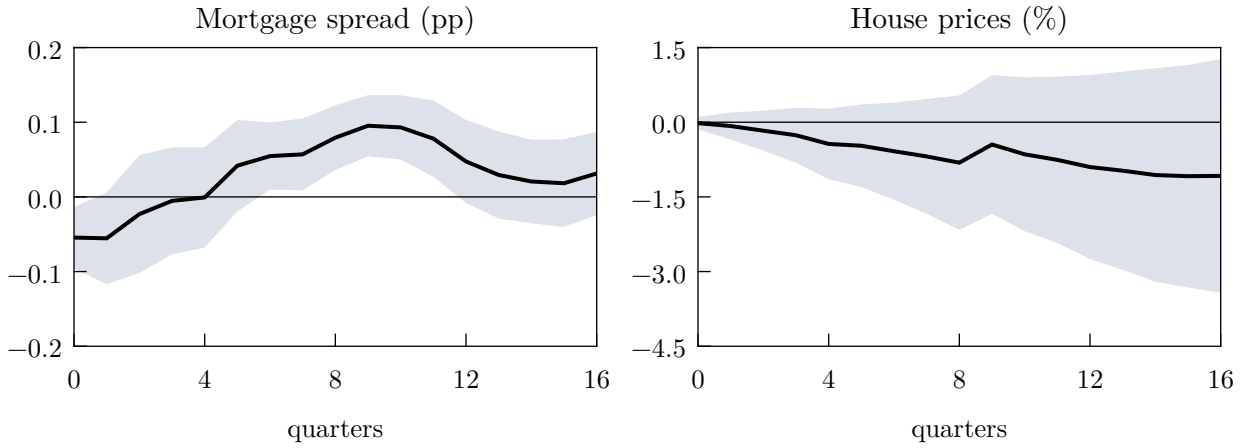


Figure 3: Impulse responses of mortgage spreads and house prices to a fall in the EBP

Notes: Impulse responses estimated by local projection as described in equation (37). The shock is a one-standard-deviation fall in the Gilchrist and Zakrajšek (2012) excess bond premium. Mortgage spreads are the average 30-year fixed mortgage rate minus the ten-year Treasury yield. House prices are from the FHFA's quarterly purchase-only house price index. Shaded bands are 95 percent confidence intervals based on heteroskedasticity-robust standard errors (Montiel Olea and Plagborg-Møller (2021)).

5 Quantitative model

In this section, I calibrate the model of section 2 to match portfolios in the Survey of Consumer Finances and aggregate macro and asset price moments, in order to quantify the size of the credit supply channel and study stabilization policy.

5.1 Calibration and solution method

Wealth, income and portfolios I calibrate the model to match the distributions of labor income and wealth across households in the 2022 Survey of Consumer Finances (SCF). I split equity into liquid and illiquid holdings. Liquid equity is direct holdings of equities, holdings of equities through managed funds, and private business equity. Illiquid equity is equity held through retirement and education savings accounts. To impute capital holdings from the equity data, I adjust for leverage in the 2022 Financial Accounts. The capital-to-equity ratio is 1.4 in the consolidated corporate and financial business sectors, net of pension and investment funds, and 1.2 in the noncorporate business sector. I define debt as credit card debt, vehicle loans and other consumer installment loans, excluding student loans.

My groups follow the same split as in section 4.2, which sorts households on consumer credit and on securities holdings. I identify "debtor" households as those reporting positive consumer credit. A household is an "investor" if it does not have consumer credit, but does have liquid capital holdings. Finally, I am left with a residual group with neither consumer credit nor liquid capital, which I exclude from the model. This group accounts for 13 percent of labor income, which I reassign proportionally between the other two groups, and two percent of capital, which I reassign to the investor group.

Table 6 summarizes the portfolios, income and population size of the three groups in the SCF. The debtor group is the largest, at 61 percent of the population, 59 percent of labor income and 56 percent of total income, and holds 29 percent of total capital. This group has aggregate consumer credit debt of 1.7 percent of total capital. The investor group is 15 percent of the population but is richer, accounting for 27 percent of labor income and 33 percent of total income, and much wealthier, holding 69 percent of total capital. The residual group is 23 percent of the population, but is poorer, accounting for 13 percent of labor income and 12 percent of total income, and is less wealthy, holding two percent of total capital entirely through illiquid accounts. If consumption and the saving rate both increase with income, as documented by Dynan, Skinner, and Zeldes (2004) and Straub (2019), the population and total income shares imply bounds on the debtor share of total consumption of 51 percent and 68 percent.

	Share of total (%)			Share of capital (%)		
	Population	Labor income	Total income	Debt	Liquid capital	Illiquid capital
Debtors	61.4	59.5	55.6	1.7	20.7	8.6
Investors	15.3	27.1	32.6	0.0	58.1	10.5
Residual	23.3	13.4	11.8	0.0	0.0	2.2

Table 6: Portfolios, income and population size in the 2022 Survey of Consumer Finances

Notes: Debtors are households with positive consumer credit; investors have no consumer credit but positive liquid capital; the residual group is all other households. Liquid capital is direct equity holdings, equity held through mutual and other managed funds, and private business equity, adjusted for leverage in the 2022 Financial Accounts. Illiquid capital is equity held through retirement accounts and education accounts, adjusted for leverage. Consumer credit is credit card debt, vehicle loans and other installment debt, excluding student loans. Labor income is wage and salary income and half of reported business income, plus unemployment insurance, Social Security and other transfer income, net of federal income and payroll taxes computed using NBER TAXSIM. Total income adds the remaining half of business income, interest, dividends, and rent, royalty and other income, excluding realized capital gains, net of taxes computed using NBER TAXSIM. Debt, liquid capital and illiquid capital shares are each expressed as a percentage of total capital (liquid plus illiquid) across all three groups; population, labor income and total income shares are expressed as a percentage of their respective totals across all three groups. Estimates are computed using multiple imputation.

Externally set parameters I first set a number of parameters consistent with the literature or external data sources, as summarized in table 7. I set the death rate ξ to 0.01, implying an expected household lifespan of 25 years. I set the masses of investors and debtors, λ^i and λ^d, and labor allocations, $\bar{l}^i$ and $\bar{l}^d$, to match the population and labor income shares in the SCF, reweighting after excluding the residual group, which gives $\lambda^i = 0.199$ and $\bar{l}^i = 0.31$. I set the share of wealth going to newborn investors $\bar{\eta}$ equal to the investor population mass. I set the Frisch elasticity ν equal to 0.75, following Chetty, Guren, Manoli, and Weber (2011). I set $\bar{\nu}$ so that labor supply in the deterministic steady state is $\bar{l}^j/\lambda^j$ for each household type. I set the capital share α to 0.36 and δ to 2.5 percent, standard values in the literature. I set χ^k to 2 so that adjustment costs are a quadratic function of the growth in the capital stock. I set the Phillips curve parameters ε to 5 and χ^W to 663 to match the Calvo-equivalent quarterly wage adjustment probability of 18.5 percent found by Grigsby, Hurst, and Yildirmaz (2021).[10] I set the Taylor rule coefficient to 1.5, following Taylor (1993). I set the disaster probability to 0.5 percent per quarter, consistent with Barro (2006), and the productivity disaster size to 10 percent, the median permanent drop in consumption across disasters in Nakamura, Steinsson, Barro, and Ursúa (2013). Finally,

[10]The elasticity parameter ε is typically set exogenously (Huo and Ríos-Rull (2020)); five is in the range of values commonly used in the literature. See, e.g., Levin, Onatski, Williams, and Williams (2005), Smets and Wouters (2007) and Galí (2015).

Description	Value	Notes
ξ: death rate	0.01	
λ^i: investor population mass	0.199	SCF
λ^d: debtor population mass	0.801	SCF
$\bar{l}^i$: investor labor allocation	0.31	SCF
$\bar{l}^d$: debtor labor allocation	0.69	SCF
$\bar{\eta}$: newborn investor wealth share	0.199	λ^i
ν: Frisch elasticity	0.75	Chetty et al. (2011)
α: capital share	0.36	
δ: depreciation rate	0.025	
ε: elast. subs. workers	5	
χ^W: Rotemberg costs	663	Grigsby et al. (2021)
χ^k: capital adjustment exponent	2	
ϕ: Taylor coefficient	1.5	Taylor (1993)
p^d: mean disaster probability	0.5%	Barro (2006)
φ^z: productivity disaster	10%	Nakamura et al. (2013)
ρ^γ: intermediary CRRA persistence	0.8	$\rho(EBP_t, EBP_{t-1})$

Table 7: Externally set parameters

I set ρ^γ to 0.8 to match the quarterly autocorrelation of the excess bond premium.

Calibrated parameters I calibrate the remaining parameters to match a set of moments in the data, as summarized in table 8. I set the discount factor of the investor β^i to 0.988 to target a mean annualized risk-free rate of 0.7 percent. I set the discount factor of the debtor β^d to 0.966 to target a mean investor share of domestic wealth of 72.4 percent, consistent with the SCF data. I set the minimum capital share $\bar{k}$ to 0.155 to target a debtor capital share of total capital of 29.3 percent, consistent with the SCF data. I set the mean intermediary risk aversion $\bar{\gamma}$ to 34.34 to target a 7.9 percent mean annualized equity premium, in line with the mean implied equity premium estimated by Tetlock, McCoy, and Shah (2023). In the model, equity is a levered claim to capital with a debt-to-equity ratio of 0.5 (as in Barro (2006)). I set the intermediary risk aversion volatility σ_γ to 1.78 to target a quarterly consumption growth volatility of 0.56 percent. I set the default disaster size φ^b to 0.13 to target a 6.8 percent bond risk premium, consistent with the excess return on credit cards estimated by Drechsler, Jung, Peng, Supera, and Zhou (2025). I set the intertemporal elasticity of substitution ψ to 0.77 to target a quarterly investment growth volatility of 1.8 percent. I set

Description	Value	Moment	Target	Model
β^i: discount factor	0.988	4E[risk-free rate]	0.7%	0.7%
β^d: discount factor	0.966	E[η^i]	72.4%	72.4%
γ: intermediary risk aversion	34.338	4E[eq. prem.]	7.9%	7.9%
$\bar{i}$: monetary policy intercept	0.002	4E[infl.]	0.0%	0.0%
σ_z: productivity volatility	0.004	$\sigma(\Delta \log l)/\sigma(\Delta \log y)$	1.2	1.2
ψ: IES	0.774	$\sigma(\Delta \log x)$	1.8%	1.8%
$\bar{k}$: min. capital	0.155	E[debtor cap./total cap.]	29.3%	29.3%
σ_γ: intermediary risk aversion vol.	1.775	$\sigma(\Delta \log c)$	0.6%	0.6%
z^b: bond default intercept	-0.137	4E[charge-off rate]	4.5%	4.5%
κ: bond default slope	32.82	$\sigma(\Delta$ charge-off rate)	0.6%	0.6%
φ^b: bond default disaster	0.132	4E[bond prem.]	6.8%	6.8%

Table 8: Calibrated parameters

Notes: Model moments are computed by simulating the model without drawing disasters for 2000 periods from the stochastic steady state, discarding the first 100 periods, and averaging across 5000 simulations. Data moments are computed from 1994Q1 to 2025Q1 or taken from the literature. Second moments drop 2020Q2 and 2020Q3.

productivity volatility to 0.004 to target a ratio of hours to output growth volatility of 1.2. I set the Taylor rule intercept to 0.0017 to target an inflation rate of 0 percent. I set $\bar{z}^b$ to -0.14 to match the mean of the charge-off rate on credit cards at commercial banks and κ to 32.82 to match the standard deviation of changes in the charge-off rate.

Solution method I solve the model globally using sparse grids as in Judd, Maliar, Maliar, and Valero (2014) over the state space $\{\eta_t, w_{t-1}, k_{t-1}, \gamma_t\}$: the investor's wealth share, the lagged real wage, the capital stock and intermediary risk appetite. I form expectations using Gauss–Hermite quadrature and interpolate states off the grid using Chebyshev polynomials. I solve for the stochastic equilibrium using backward iteration, damping updates at each step for numerical stability. The solution algorithm is similar to Kekre and Lenel (2022) and Alston, Gonçalves, and Lenel (2026) and is described in appendix C.1.

5.2 Model validation

In this section, I validate the quantitative fit of the model. Throughout, I compare the baseline model to a version of the model where only the capital channels are active. In this version of the model, I set the mass of debtors to zero, so that the economy is populated entirely by investors, and calibrate the model to match the same set of moments. The

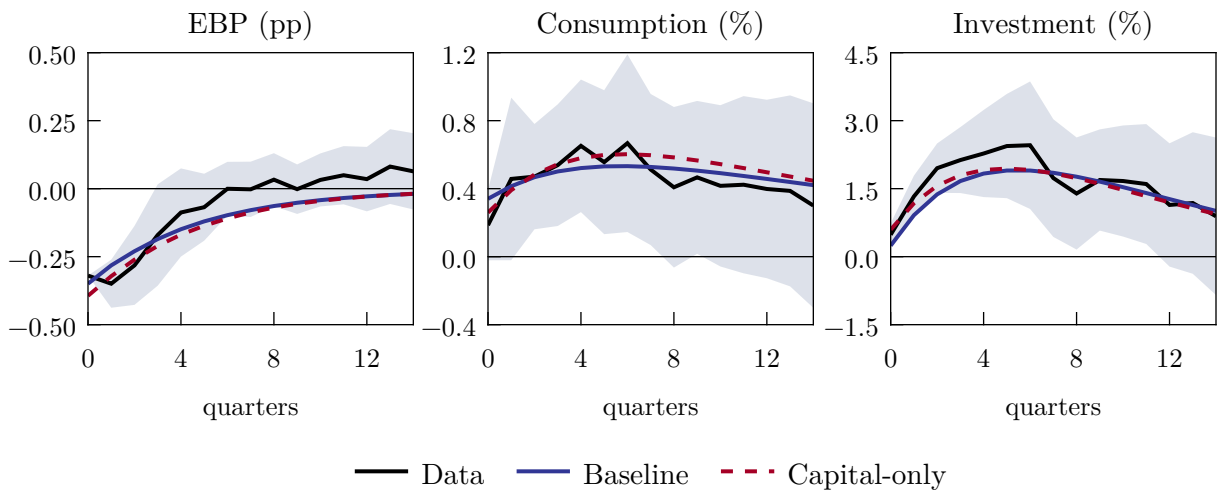


Figure 4: Impulse responses in the model and data

Notes: Impulse responses in the model are to a one-standard-deviation decrease in intermediary risk aversion from the stochastic steady state. The response is the average path relative to no shock across 1000 simulations. Impulse responses in the data are estimated as in section 4.1, with the excess bond premium rescaled so that the peak response in standard deviations is the same as in the model.

capital-only calibration is described in appendix C.2.

Impulse response functions I first compare the impulse responses of consumption and investment to a risk premia shock to the empirical impulse responses estimated in section 4.1. Figure 4 shows the impulse responses of the baseline model, capital-only model and the data for an innovation in the excess bond premium. In the model, variation in the risk premium on the risky bond is almost entirely driven by the price of risk, making it appropriate as a model analogue for the excess bond premium in the data, up to scale. The capital premium has a correlation of one with the bond premium, so results would be quantitatively unchanged using the capital premium instead. Both the baseline and capital-only models are close to the empirical impulse response.

Consumption risk premia regressions Next, I replicate the regressions in section 4.2 in the model, and repeat the same specification using aggregate personal consumption expenditures data. Table 9 reports the regression results of consumption growth on the excess bond premium and its lag, in the data and on simulated data from the two models. The baseline model replicates the aggregate relationship in the data. The capital-only model is also close to the data, though slightly smaller in magnitude. The CEX estimates have large standard errors, and the point estimates imply an aggregate below the PCE data in magnitude. As a result, the model produces estimates larger in magnitude than those in

	Data	Baseline	Capital-only
$\hat{\beta}$: $\Delta \log c_t = \alpha + \beta EBP_t + \gamma EBP_{t-1} + \epsilon_t$			
Aggregate	-2.4 (1.1)	-2.4	-2.1
Investors	-1.1 (1.2)	-1.3	-2.1
Debtors	-2.3 (0.9)	-2.9	–

Table 9: Consumption growth and the excess bond premium in the model and data

Notes: The table reports $\hat{\beta}$ from a regression of consumption growth on the Gilchrist and Zakrajšek (2012) excess bond premium and its lag. The empirical regressions are described in appendix C.3. The capital-only column is a version of the model with a single household and no household debt, recalibrated to the same set of moments. Model moments are computed by simulating the model without drawing disasters for 2000 periods from the stochastic steady state, discarding the first 100 periods, and averaging across 5000 simulations.

the CEX, but the debtor estimate in the model is larger in magnitude than the investor estimate roughly in proportion to the corresponding estimates in the CEX. In contrast, the capital-only model attributes all of the comovement to households with capital, implying an estimate for securities holders larger in magnitude than in the CEX, but smaller than the aggregate.

Aggregate Euler equation estimates Next, I estimate aggregate log-linear Euler equations following Hansen and Singleton (1983), Hall (1988) and Yogo (2004). I estimate

$$\Delta \log C_{t+1} = \alpha + \psi r_{t+1} + u_{t+1}, \tag{40}$$

where C_{t+1} is aggregate consumption in the model and real per capita nondurables and services consumption excluding housing and education in the data, r_{t+1} is the realized real return on the safe bond in the model and the realized real three-month Treasury bill yield in the data. I estimate (40) instrumenting for r_{t+1} with the nominal interest rate, inflation, consumption growth and the excess bond premium at $t-1$. I estimate the reverse specification,

$$r_{t+1} = \alpha + \frac{1}{\psi} \Delta \log C_{t+1} + v_{t+1}, \tag{41}$$

using the same instruments. As discussed in Yogo (2004), the general finding in the literature is that the estimated $\widehat{\psi}$ in equation (40) is small, but that the estimated $\widehat{1/\psi}$ in equation (41) is also small, so that there is a disconnect between safe interest rates and consumption growth, contrary to predictions of standard macro models.

Table 10 shows the resulting estimates. In both the capital-only and baseline models, no household is on the safe bond Euler equation, so the financial shocks drive a time-varying

	Data	Baseline	Capital-only
$\hat{\psi}$: $\Delta \log C_{t+1}$ on r_{t+1}	0.02	0.11	0.22
	(-0.30, 0.35)	(-0.20, 0.38)	(-0.06, 0.46)
$1/\hat{\psi}$: r_{t+1} on $\Delta \log C_{t+1}$	0.27	0.94	1.66
	(-0.88, 1.42)	(-2.46, 3.83)	(-0.74, 4.06)
Structural IES ψ	–	0.77	0.68

Table 10: Estimated elasticity of intertemporal substitution in the model and data

Notes: Two-stage least squares regressions of $\Delta \log C_{t+1}$ on r_{t+1} and of r_{t+1} on $\Delta \log C_{t+1}$. In the data, r_{t+1} is the three-month Treasury bill yield at t less realized inflation over $t+1$. In the model, r_{t+1} is the ex post real return on the risk-free bond. The instruments are the nominal rate, inflation, consumption growth and the excess bond premium at $t-1$. The data are quarterly from 1994Q3 to 2025Q1. Column 1 reports the 95 percent confidence interval using Newey–West standard errors. Columns 2 and 3 report the median across 5000 simulated samples of 123 quarters, with the 2.5 and 97.5 percentiles in parentheses.

wedge between the investor household stochastic discount factor and the safe bond return. Utility in the model is also nonseparable in labor, which in simulations introduces an upward bias in the estimates of ψ from equation (40). On net, the estimates of ψ in both models are biased toward zero and close to the data. Introducing debtors in the baseline model further pushes estimates of ψ and $1/\psi$ toward zero. The marginal rate for debtors $R^{b,0}_{t+1}$ contains both the risk-free rate and the time-varying bond risk premium. The spread is negatively correlated with the risk-free rate, since increases in risk premia are deflationary. On net this leads to a weak correlation between the risk-free rate and the borrowing rate for debtors, leading to estimates of ψ and $1/\psi$ closer to the data.

Other untargeted moments Finally, I compare a number of other untargeted moments, reported in table 11. Both models slightly overstate the volatility of output growth, at 0.8 percent against 0.6 percent in the data. Figure 12 in appendix B.1 shows that a decrease in the excess bond premium is associated with a fall in net exports, as foreign capital flows into the US economy to finance the increase in consumption and investment. A closed economy does not allow for this dynamic, leading to output volatility that is slightly too high relative to the data. The models are fairly close on the correlations of output and hours growth with the excess bond premium. The standard deviation of the bond premium, scaled by its mean, is also close to the standard deviation of the excess bond premium relative to the mean of the Gilchrist and Zakrajšek (2012) spread. Both models produce aggregate quarterly MPCs for nondurables within the range of estimates that correct for biases in two-way fixed effects estimators (Borusyak, Jaravel, and Spiess (2024), Orchard, Ramey, and Wieland (2025)).

Moment	Data	Baseline	Capital-only
$\sigma(\Delta \log y_t)$	0.6%	0.8%	0.8%
$\rho(\Delta \log y_t, \Delta \log y_{t-1})$	0.34	0.24	0.26
$\text{Cor}(\Delta \log y_t, \text{EBP}_t)$	-0.61	-0.50	-0.53
$\text{Cor}(\Delta \log l_t, \text{EBP}_t)$	-0.72	-0.60	-0.62
$\sigma(\text{EBP}_t)/\text{E}[\text{spread}_t]$	0.30	0.26	0.29
$\sum_j \lambda^j \text{MPC}^j$: aggregate MPC	0–0.1	0.03	0.02

Table 11: Untargeted moments

Notes: Data moments are quarterly, from 1994Q1 to 2025Q1, excluding 2020Q2 and 2020Q3. Output is real GDP and hours are nonfarm business sector hours of all workers. Model moments are computed as in table 8. In the data, $\sigma(\text{EBP}_t)/\text{E}[\text{spread}_t]$ is the standard deviation of the excess bond premium divided by the mean of the Gilchrist and Zakrajšek (2012) spread. In the model $\sigma(\text{EBP}_t)/\text{E}[\text{spread}_t]$ is the standard deviation of the bond premium divided by the mean of the bond premium.

5.3 Results

I now use the model to measure the contribution of the three channels, and the contribution of risk premia fluctuations relative to productivity.

5.3.1 Impulse response to an intermediary risk preference shock

Figure 5 shows the impulse response to a fall in intermediary risk aversion. The shock lowers the expected excess return on both capital and risky bonds, leading to a boom in investment, debt and consumption. These responses are qualitatively consistent with the analytical results in section 3.

Figure 6 decomposes the aggregate output response into debtor consumption, investor consumption and investment. The shock generates an investment boom accounting for around half of the output increase over the first two years. Debtors account for 77 percent of the consumption increase over the same period, owing to their higher consumption share and greater responsiveness to the risk premia shock.

5.3.2 Decomposing the consumption response

To measure the contributions of each channel, I shut down each channel in the model with tax wedges. The model is solved with perfect foresight over the value of the taxes at each point in time along the transition path following a shock to γ. To undo the effect of the credit supply channel, I introduce a wedge in the intermediary bond pricing equation that offsets the effect of the change in borrowing rates from the shock to γ. The bond return is

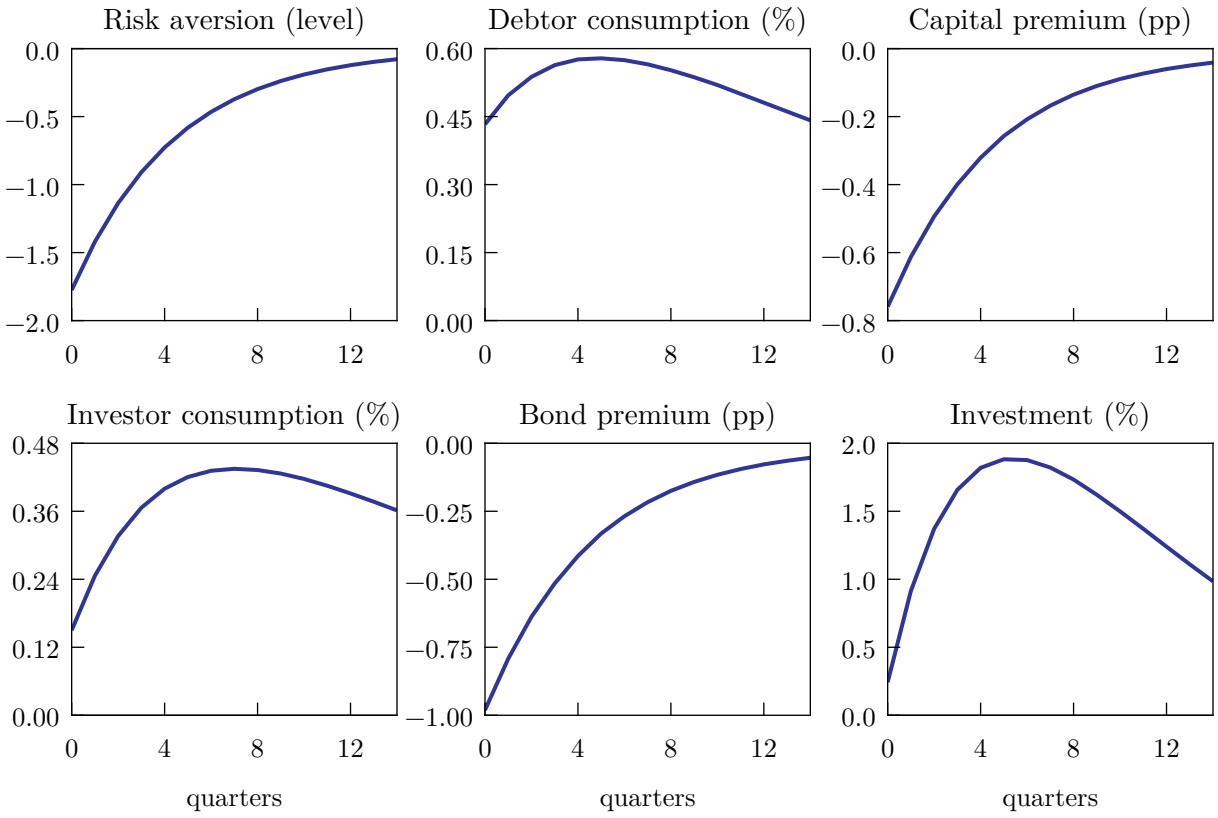


Figure 5: Impulse response to an intermediary risk aversion shock

Notes: Impulse responses are to a one-standard-deviation decrease in intermediary risk aversion from the stochastic steady state. The response is the average path relative to no shock across 1000 simulations.

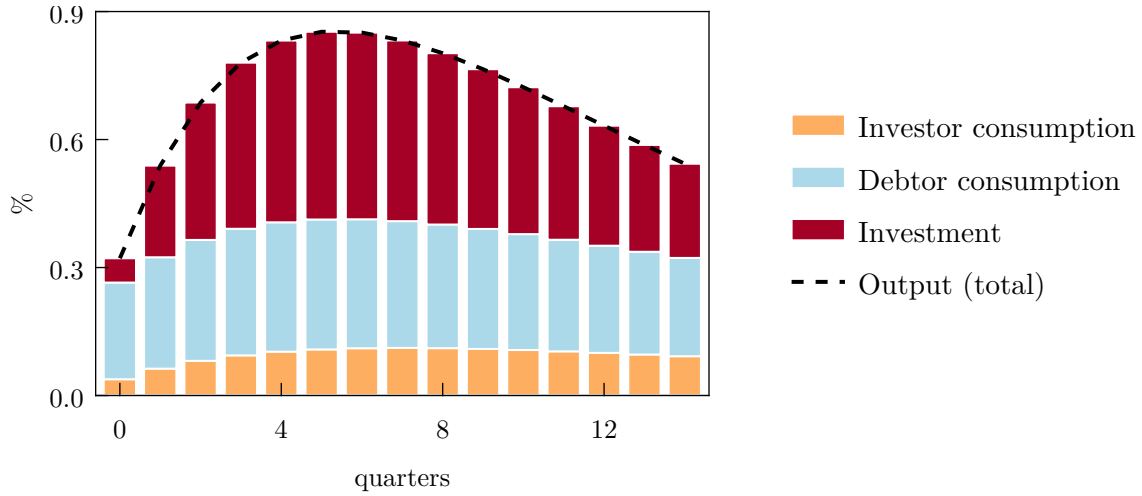


Figure 6: Decomposition of the output response

Notes: Impulse responses are to a one-standard-deviation decrease in intermediary risk aversion from the stochastic steady state. The response is the average path relative to no shock across 5000 simulations.

taxed at a rate τ_t^b so that the priced return for the intermediary is $R_{t+1}^b(1-\tau_t^b)$ and τ_t^b is set so the expected excess return on the bond over the risk-free rate is the same as in the baseline path with no shock to intermediary risk aversion. Similarly, I introduce a capital wedge so that the priced return is $R_{t+1}^k(1-\tau_t^k)$ and the spread of capital over the risk-free rate is the same as in the baseline path.

The model is solved globally, so each channel has a nonlinear effect on the model. To estimate the contribution of each channel, I calculate the change in consumption with neither channel, each channel alone, and both channels active. Let $S \subseteq \{k, b\}$ be a set of active channels. The consumption response with a set of channels S active over T quarters is

$$v(S) = \sum_{t=1}^{T} \left(C_t^S - C_t^0\right),$$

where C_t^S is the path of aggregate consumption under a shock to γ where the channels in S are active and C_t^0 is the baseline path for consumption without a shock to γ. The contribution of the capital channel is then given by its Shapley value,

$$\tfrac{1}{2}\left[v(\{k\}) - v(\emptyset)\right] + \tfrac{1}{2}\left[v(\{k, b\}) - v(\{b\})\right], \tag{42}$$

with the bond contribution defined symmetrically. I further decompose the capital channel along the lines of proposition 2, into its effects on incomes and wealth, which, using household consumption policies, can be read off the change in aggregates along each simulated path. The derivation is in appendix C.4. For every set of channels S, the consumption response can be decomposed into an income component, a wealth component for each type, and a residual. The capital channel's contribution through each component is then calculated as in (42), where $v(S)$ is instead replaced with each component. Since the components sum to $v(S)$ in every set of channels, these contributions sum to the capital channel's contribution.

Figure 7 shows the resulting decomposition. Credit supply is the dominant channel in the short run, with the bond premium accounting for 75 percent of the cumulative consumption response over the first year. The increase in incomes from the capital channel also raises consumption, contributing 83 percent over the first year. However, there is only a small wealth effect on investor consumption, and it is more than offset by the increase in safe rates, which weighs on debtor consumption. Overall, the wealth effects from the capital channel weigh on consumption in the first year, contributing -52 percent to aggregate consumption. The bond channel gradually fades out and eventually reverses, weighing on consumption in the medium term. Nonetheless, consumption remains elevated due to persistently higher incomes and a reversal in expected risk-free rates.

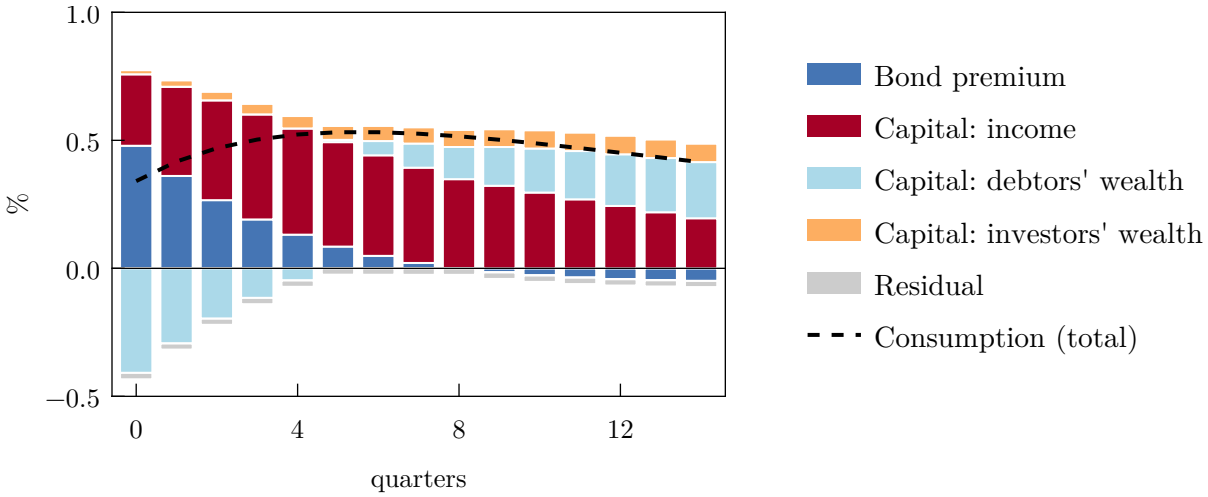


Figure 7: Decomposition of the consumption response

Notes: Impulse responses are to a one-standard-deviation decrease in intermediary risk aversion from the stochastic steady state.

5.3.3 Variance decomposition

Risk premia shocks, rather than productivity shocks, account for most fluctuations in the model. Figure 8 shows the forecast error variance decomposition for output, consumption and investment in the model. For consumption, I split the risk premia share into the capital and bond premia using the decomposition in section 5.3.2. High-frequency consumption fluctuations are primarily due to the response of the bond premium, while the capital premium plays a stronger role in the medium term. Investment is primarily driven by shocks to risk premia, except in the first three quarters, due to the hump-shaped response seen in figure 5. The majority of output volatility out to 40 quarters is due to risk premia shocks, except at one and two quarters.

5.3.4 Historical decomposition

I use the model to decompose the time series of consumption, investment and output from 1994Q1 to 2019Q4, ending just prior to the Covid recession, into risk premia shocks and productivity shocks. Given a state at time t, I invert the model to recover shocks to productivity z_t and intermediary risk aversion γ_t from the data on GDP and the EBP at $t+1$. To initialize the procedure in 1993Q4, I draw the states η_t, w_{t-1}, k_{t-1} from the ergodic distribution and select γ_t to match the normalized distance of EBP_t from its mean. Given the time series of shocks, I then calculate the contribution of each shock to the time series of output, consumption and investment as in (42), simulating the time series with and without each

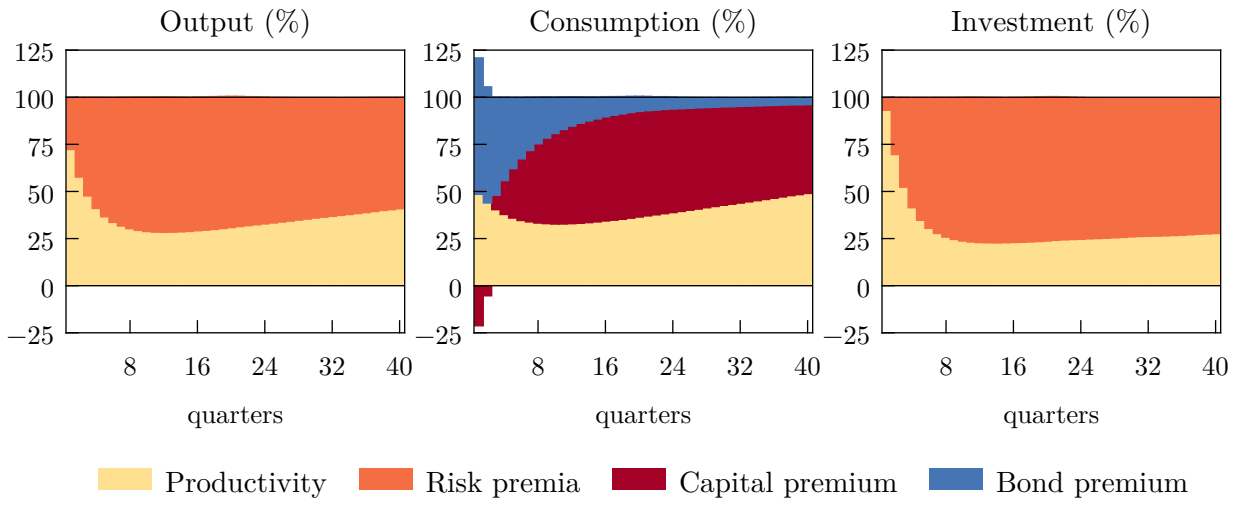


Figure 8: Forecast error variance decomposition

Notes: Share of the variance of the h-quarter-ahead forecast error of log output, consumption and investment due to each shock. The forecast error variance decomposition of shock $j \in \{z, \gamma\}$ for variable x at horizon h is

$$\text{FEVD}_{j,h}^{x} = 1 - \frac{\mathbb{E}\left[\text{Var}\left(x_{t+h} \mid \{\epsilon_{\tau}^{j}\}_{t<\tau\leq t+h}, S_t\right)\right]}{\mathbb{E}\left[\text{Var}\left(x_{t+h} \mid S_t\right)\right]},$$

where S_t is the state. The FEVD is computed by simulating 375 draws of shocks from each of 800 draws of S_t from the ergodic distribution. For consumption, the forecast error due to shocks to γ is split into the capital and bond premia using their contributions to the consumption response at each horizon in section 5.3.2, treating the response as linear. The risk premia share is then split by each premium's average share of the forecast error across simulations.

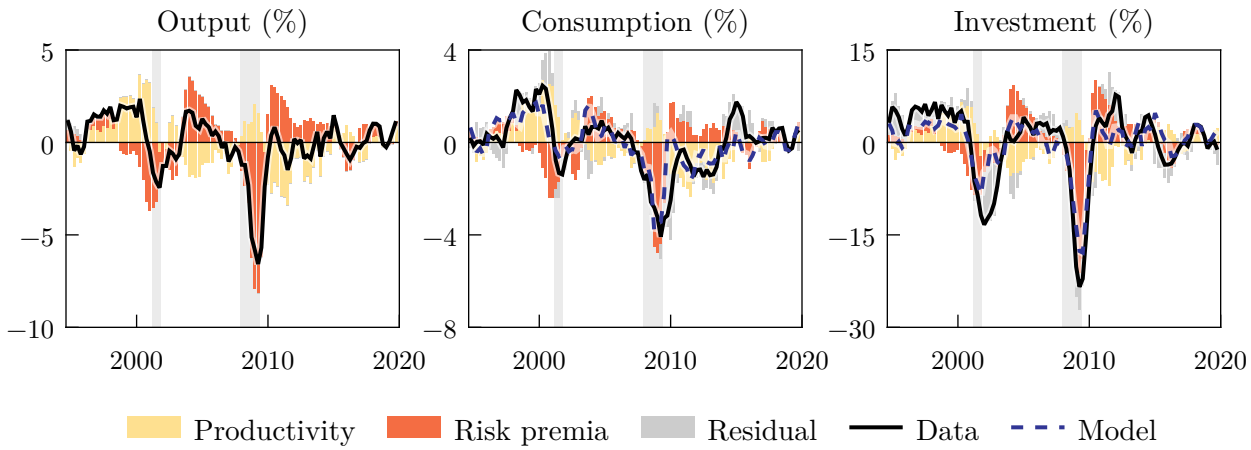


Figure 9: Historical decomposition of year-over-year growth

Notes: The solid lines show demeaned year-over-year growth in output, consumption and investment per capita in the data. The dashed lines show consumption and investment growth in the model. Bars are the contribution of each shock averaged over 100 draws of the initial state. Shaded areas are NBER recessions.

shock series.

Figure 9 shows the resulting decomposition of year-over-year growth in output, consumption and investment. Consistent with a dominant role for risk premia in business cycle fluctuations, risk premia shocks are responsible for both recessions in the sample, and the subsequent recoveries. Productivity shocks drive slower-moving variation, including both the late 1990s boom and the sluggish recovery after the Great Financial Crisis. The figure also includes residuals for the consumption and investment series, since these series are untargeted in the model inversion. The model can account for 60 percent of the variance of year-over-year consumption growth and 74 percent for investment.

5.4 Stabilization policies

Finally, I study business cycle stabilization policies in my model. I model macroprudential policy as financial taxes on capital and bonds (as in Bianchi (2011), Korinek and Simsek (2016), Farhi and Werning (2016), Dávila and Korinek (2018), Jeanne and Korinek (2019)). As a fiscal benchmark, I also consider lump-sum transfers, paid equally to all households. In all cases, the policies are deficit financed by nominal government debt B_t priced at the safe interest rate i_t. Government debt is held by the intermediary. The financial taxes are linear in the risk premium in each market,

$$-\tau_t^j = a^j \left(\mathbb{E}_t \left[R_{t+1}^j - (1+i_t) \frac{P_t}{P_{t+1}} \right] - \overline{\mathrm{rp}}^j \right), \qquad j \in \{k, b\}, \tag{43}$$

where $\overline{\text{rp}}^j$ is set so that the financial tax is zero on average over the cycle. Purchasers of capital pay $q_t^k/(1-\tau_t^k)$ so that the return is $(1-\tau_t^k)R_{t+1}^k$. Lenders pay $q_t^b/(1-\tau_t^b)$ so that they receive gross interest $(1-\tau_t^b)R_{t+1}^b$. Similarly, the lump-sum transfers are linear in the bond premium,[11]

$$T_t = a^T \left(\mathbb{E}_t \left[R_{t+1}^b - (1+i_t)\frac{P_t}{P_{t+1}} \right] - \overline{\text{rp}}^T \right) y_t, \tag{44}$$

where $\overline{\text{rp}}^T$ is set so that lump-sum transfers are zero on average over the cycle.

In order to model an efficiency cost of each policy, government debt is financed by distortionary taxes on total factor income, τ_t^y. Income taxes adjust to the stock of government debt based on a fiscal rule,

$$\tau_t^y \frac{W_t l_t + \Pi_t k_{t-1}}{P_t} = \phi^b (1+i_{t-1}) \frac{B_{t-1}}{P_t}, \tag{45}$$

where ϕ^b governs the speed of fiscal adjustment. I set $\phi^b = 0.05$.

I measure the fiscal cost of a policy as the present value of the additional taxes required in response to a one-standard-deviation increase in intermediary risk aversion, discounted at the safe interest rate. I set $a^j = 0.5$ for both the capital and bond taxes, and choose a^T so that the cost of the transfers is the same as the cost of the capital tax. The smaller asset tax base means that the bond tax is substantially cheaper, costing only 3 percent of the capital tax.

Figure 10 shows the response to an increase in intermediary risk aversion under each policy. The bond tax stabilizes aggregate consumption on impact, cutting the initial decline by 46 percent. However, subsidizing lending to households crowds out investment, exacerbating the effects of the shock. As a result, consumption reaches about the same trough as under no policy intervention. Similarly, fiscal transfers dampen the decline, but also crowd out investment as the intermediary purchases government debt at the expense of capital. In contrast, under the capital tax, the initial decline in consumption is close to the baseline, but by supporting investment, the recovery from the shock is much faster. Over the ergodic distribution, the capital tax lowers the standard deviation of detrended consumption from 2.29 to 1.58 percent. In contrast, the bond tax and transfers leave the standard deviation only slightly lower at 2.24 percent and 2.16 percent, respectively. Consumption growth volatility falls, but the larger fluctuations in investment lead to more persistent changes in consumption levels, leaving lower-frequency consumption volatility little changed.

The capital tax is effective in supporting a fast recovery from the shock, but not in

[11] Since the bond and capital premia are perfectly correlated, this is equivalent to a rule based on the capital premium, up to a rescaling of a^T.

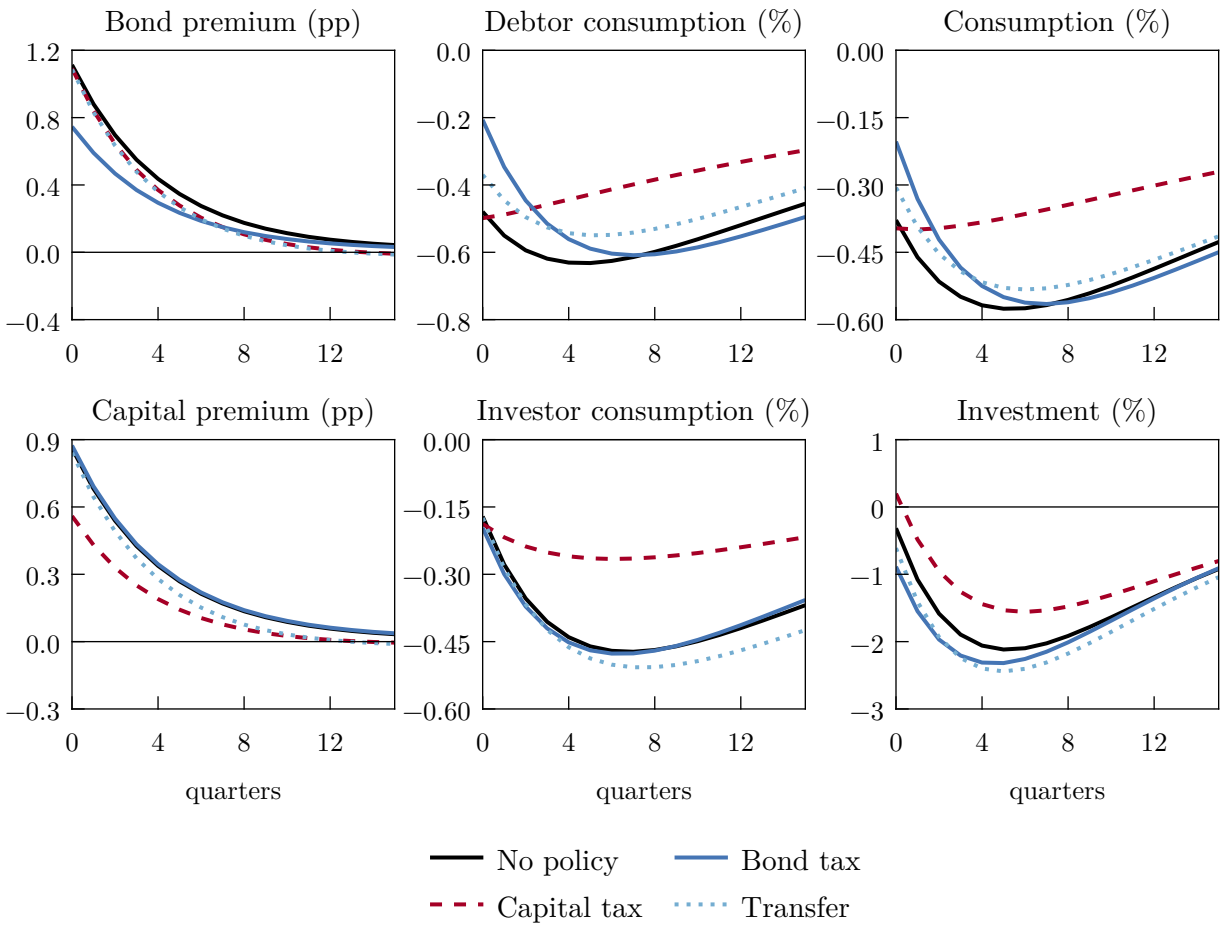


Figure 10: Impulse response to a risk aversion shock with stabilization policies

Notes: Impulse responses are to a one-standard-deviation increase in intermediary risk aversion from the stochastic steady state of the baseline model. The response is the average path relative to no shock across 5000 simulations.

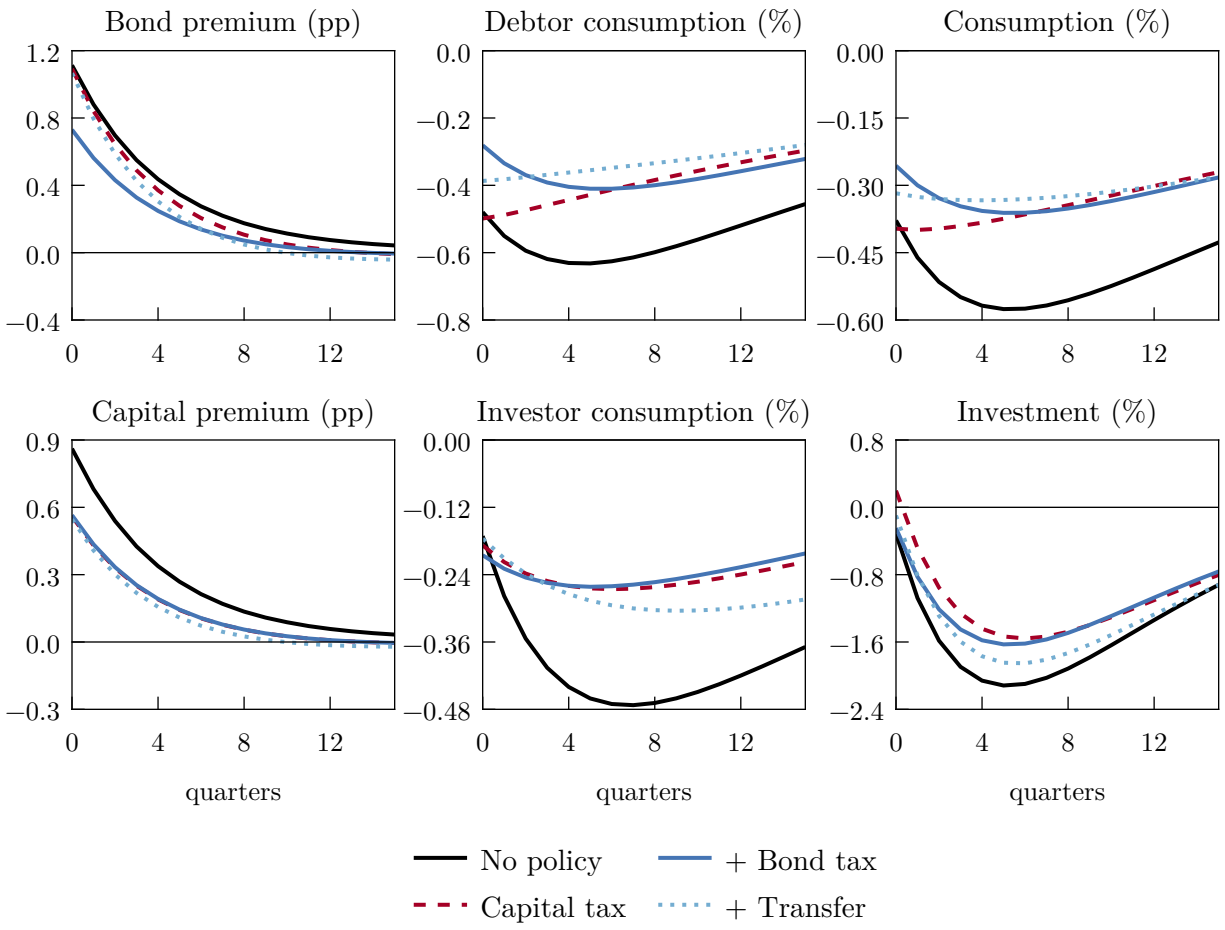


Figure 11: Impulse response to a risk aversion shock with combined policies

Notes: Impulse responses are to a one-standard-deviation increase in intermediary risk aversion from the stochastic steady state of the baseline model. Each combination adds the bond tax or the transfer to the capital tax. The response is the average path relative to no shock across 5000 simulations.

stabilizing the immediate fall in consumption, suggesting some complementarity between the different policies. In figure 11, I consider the effects of supplementing the capital tax with additional support for consumption through the bond tax or transfers. Both policies are able to mitigate the initial consumption decline while keeping the medium-term path for consumption broadly unchanged from just the capital tax. The two supplementary policies have starkly different fiscal costs, however, with the transfers adding a present value of income taxes equal to 1.16 percent of quarterly output, while the bond tax costs only 0.15 percent of quarterly output. The bond tax is more cost-effective in stabilizing consumption because it directly targets the intertemporal price of consumption for debtors, rather than relying on households' low marginal propensity to consume out of transfers.

These results relate to the financial conditions targeting framework of Caballero, Car-

avello, and Simsek (2024), in which the central bank uses the policy rate to stabilize a financial conditions index. Here, macroprudential policies can play a similar role by leaning against fluctuations in capital and bond financing. In my model, while the household bond premium accounts for most of the consumption response in the first year, stabilizing household credit alone does little to stabilize the level of consumption, because supporting household credit crowds out capital. Instead, combining countercyclical macroprudential policies in both household credit and capital markets lowers consumption volatility and dampens the short-run response of consumption to shifts in intermediary risk aversion. Caballero and Simsek (2026) show a related spillover in an open economy: targeting the exchange rate alone transmits its shocks to domestic asset prices and raises their volatility, while targeting a broader index of asset prices better stabilizes output fluctuations.

6 Conclusion

In this paper I study the transmission of time-varying risk premia to aggregate consumption. I provide evidence that household credit supply, a channel missing from benchmark macro-finance models, is a key driver of aggregate consumption. In the Consumer Expenditure Survey, consumption growth moves most strongly with risk premia for households with consumer credit. Incorporating household credit supply fluctuations into a quantitative New Keynesian model helps to jointly match both the aggregate and cross-sectional comovements between consumption growth and risk premia. In a decomposition of the consumption response to an increase in intermediary risk appetite, the credit supply channel accounts for 75 percent of the one-year response to a fall in risk premia. Despite the importance of household credit supply for short-term consumption fluctuations, macroprudential policy targeting household credit alone can be ineffective in stabilizing consumption: subsidizing household credit in a bust crowds out capital, exacerbating the fall in investment and delaying rather than mitigating the decline in consumption. Stabilizing capital markets in addition to household credit dampens the initial decline in consumption while sustaining investment through the recovery.

The framework advanced in this paper can be further developed in a number of dimensions. First, further endogenizing default in the model could allow for interesting dynamics over the medium term. If default depends on the stock of debt, as naturally emerges in models such as Chatterjee, Corbae, Nakajima, and Ríos-Rull (2007), credit supply shocks could raise defaults and reduce consumption in the medium term, after an initial boom in consumption and debt. Second, a richer model of the sources of credit supply fluctuations would allow for more sophisticated policy analysis. For example, Mian and Sufi (2018)

propose excesses in the global financial system, in the spirit of Bernanke (2005), as a likely driver of credit supply fluctuations. Finally, expansionary monetary policy lowers risk premia (Bernanke and Kuttner (2005)), suggesting a role for the household credit supply channel proposed in this paper in the transmission of monetary policy.

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Appendix

A Model appendix

A.1 A microfoundation for default shocks

Each debtor household consists of a continuum of members $h \in [0,1]$, each holding an equal share of the household's risky bonds. There is full risk-sharing for consumption and hours worked within each household, with a full set of Arrow securities settled in the afternoon. Each period in the morning, members must meet their debt payments from the previous period but are hit with an idiosyncratic employment shock e_{ht} and lose their job if the shock exceeds a threshold that depends on productivity growth. Specifically, members lose their job if

$$e_{ht} > \Delta \log z_t - \bar{z}^b.$$

Members who lose their job are unable to repay their debt and default. Employment shocks are independent and identically distributed across members, households and time with logistic distribution $F(x) = 1/(1+\exp(-\kappa x))$. By the law of large numbers, the share of loans repaid is

$$F(\Delta \log z_t - \bar{z}^b) = \frac{1}{1+\exp\left(-\kappa(\Delta \log z_t - \bar{z}^b)\right)}.$$

On default, intermediaries transfer the defaulted loan to debt collectors, who have recourse against the assets of the member's household, so that the household always repays the loan in full. The proceeds are paid lump sum to households in proportion to their holdings of intermediary shares, which households take as given.

A.2 Wage Phillips curve

The union representing labor variety h sets the nominal wage W_{th} to maximize the welfare of its members alive at t,

$$\sum_{j\in\{i,d\}} \lambda^j \mathbb{E}_t \sum_{s=0}^{\infty} \left((1-\xi)\beta^j\right)^s u(c^j_{t+s}, l^j_{t+s}),$$

where c^j_{t+s} is the consumption at $t+s$ of a type-j household with the type-average wealth at t, conditional on its survival. The union takes as given the wage index W_t, aggregate labor l_t and the price level P_t. Demand for variety h is given by (13), and type-j households together supply a share of total labor $\bar{l}^j$. Labor income is subsidized at rate $1/(\varepsilon-1)$, to

offset the markup. The subsidy is financed by transfers proportional to each household's labor income, which households take as given. The adjustment costs (14) paid by the union are shared across types in proportion to their labor income and within types in proportion to wealth. The union takes the total labor bill $W_t l_t$ as given. The union first-order condition implies the wage Phillips curve,

$$\sum_j \bar{l}^j \frac{du(c_t^j, l_t^j)}{dc} \left(w_t + c_t^j \frac{\Phi'(l_t^j)}{\Phi(l_t^j)} \right) = \frac{\chi^W w_t}{\varepsilon} \sum_j \bar{l}^j \frac{du(c_t^j, l_t^j)}{dc} \Bigg[\mathbb{E}_t \left(\beta^j \vartheta_{t+1}^j \frac{du(c_{t+1}^j, l_{t+1}^j)/dc}{du(c_t^j, l_t^j)/dc} \frac{w_{t+1} l_{t+1}}{w_t l_t} \frac{W_{t+1}}{W_t e^{\varphi_{t+1}}} \left(\frac{W_{t+1}}{W_t e^{\varphi_{t+1}}} - 1 \right) \right) - \frac{W_t}{W_{t-1} e^{\varphi_t}} \left(\frac{W_t}{W_{t-1} e^{\varphi_t}} - 1 \right) \Bigg], \tag{46}$$

where ϑ_{t+1}^j is the share of type-j wealth at $t+1$ held by households alive at t, who bear that share of the adjustment cost at $t+1$,

$$\vartheta_{t+1}^j = (1-\xi) \frac{\lambda^j \left[R_{t+1}^k q_t^k k_t^j + R_{t+1}^{b,0} q_t^b b_t^j + \left(R_{t+1}^I + (R_{t+1}^{b,0} - R_{t+1}^b) \omega_t^b \right) s_t^j + q_{t+1}^{n,j} \right]}{\eta_{t+1}^j R_{t+1}^k q_t^k k_t + \lambda^j q_{t+1}^{n,j}},$$

with $\eta_{t+1}^i = \eta_{t+1}$ and $\eta_{t+1}^d = 1 - \eta_{t+1}$.

A.3 A household credit surface

In this section, I show that changes in the household bond price Q_t^b of section 2 can be interpreted as a reduced-form representation of shifts in a credit surface faced by households, in the spirit of Geanakoplos (1997).

Each period, intermediaries observe a signal a_{ht} of each household member's employment shock $e_{h,t+1}$ (see appendix A.1). Signals can be interpreted as a borrower credit score (where a higher score is a lower signal). The signal and shock pairs $(a_{ht}, e_{h,t+1})$ are independent and identically distributed across members, households and time. Signals are distributed according to the CDF G. The distribution of shocks $F(e_{h,t+1}|a)$ is decreasing in a, so that higher signals indicate riskier borrowers. The share of debt repaid by borrowers with signal a is

$$\text{repay}_{t+1}(a) = \Pr\left(e_{h,t+1} \leq \Delta \log z_{t+1} - \bar{z}^b \,\middle|\, a_{ht} = a \right).$$

By the law of total probability,

$$\int \text{repay}_{t+1}(a)\, dG(a) = \text{repay}_{t+1}. \tag{47}$$

I assume that credit markets consist of a continuum of one-period loan contracts, indexed by their spread $\varsigma \geq 0$ over the risk-free rate. Lending to a borrower with signal a through product ς has real return $\text{repay}_{t+1}(a)\, e^{\varsigma} R^f_{t+1}$. Intermediaries admit the borrower to product ς if

$$\mathbb{E}_t \left[\left(R^I_{t+1}\right)^{-\gamma_t} \left(\text{repay}_{t+1}(a)\, e^{\varsigma} R^f_{t+1} - R^f_{t+1} \right) \right] \geq 0,$$

or equivalently if $\varsigma \geq \text{spread}_t(a)$, where

$$\text{spread}_t(a) = -\log \frac{\mathbb{E}_t \left[\left(R^I_{t+1}\right)^{-\gamma_t} \text{repay}_{t+1}(a)\, P_t/P_{t+1} \right]}{\mathbb{E}_t \left[\left(R^I_{t+1}\right)^{-\gamma_t} P_t/P_{t+1} \right]} \tag{48}$$

is the lowest spread at which intermediaries lend to a borrower with signal a. Define the lending standard on product ς as the riskiest signal admitted to ς,

$$\bar{a}_t(\varsigma) = \sup \left\{ a : \text{spread}_t(a) \leq \varsigma \right\}. \tag{49}$$

Households face the credit surface $\{(\varsigma, \bar{a}_t(\varsigma))\}_{\varsigma \geq 0}$.

Borrowers choose the lowest-spread product that they can access,

$$\min\{\varsigma : a \leq \bar{a}_t(\varsigma)\} = \text{spread}_t(a),$$

and receive $Q_t(a) = e^{-\text{spread}_t(a)}/(1+i_t)$ per unit of debt. As described in appendix A.1, each member of a household holds an equal share of the household's risky bonds, so a debtor household receives the mean price per unit of debt,

$$Q^b_t = \int Q_t(a)\, dG(a). \tag{50}$$

The household's budget constraint (9), capital constraint (8) and first-order condition are then the same as in section 2.

Integrating $Q_t(a)$ over signals and using (48), (47) and (50),

$$Q^b_t = \frac{\mathbb{E}_t \left[\left(R^I_{t+1}\right)^{-\gamma_t} \text{repay}_{t+1}\, P_t/P_{t+1} \right]}{\mathbb{E}_t \left[\left(R^I_{t+1}\right)^{-\gamma_t} R^f_{t+1} \right]}.$$

Dividing by Q_t^b gives $\mathbb{E}_t\left[\left(R_{t+1}^I\right)^{-\gamma_t}\left(R_{t+1}^b - R_{t+1}^f\right)\right] = 0$ with $R_{t+1}^b = \text{repay}_{t+1} R_{t+1}^{b,0}$, the intermediary's first-order condition for risky bonds in section 2. The intermediary pays Q_t^b per unit of debt and is repaid repay_{t+1} by (47), so its return on household debt is R_{t+1}^b and its portfolio return R_{t+1}^I is the same as in section 2.

A decrease in γ_t lowers $\text{spread}_t(a)$, so every product's standard loosens and each household member moves along the surface to a product with a lower spread. Changes in Q_t^b can therefore be interpreted as shifts in a credit surface faced by households.

A.4 A microfoundation for risk-aversion shocks

In this section, I provide a microfoundation for the shocks to intermediary risk aversion in section 2, similar in spirit to the intermediary asset pricing models of He and Krishnamurthy (2013) and Brunnermeier and Sannikov (2014).

Each period, a continuum of agents operating financial intermediaries are born, endowed with wealth ζ and live for one period. Intermediaries consume all of their wealth in the next period and then die. Intermediaries receive utility

$$\mathbb{E}_t\, c_{t+1}^{1-\gamma^I}/(1-\gamma^I)$$

from consumption at $t+1$. In a morning market, intermediaries issue equity to households, who hold a pooled claim on the intermediary sector. After the equity market closes, a fraction θ_t of intermediaries receive an investment opportunity, as in Gertler and Kiyotaki (2010), and can trade capital, risky bonds and nominal bonds. The remaining fraction $1-\theta_t$ of intermediaries instead lend their raised funds to investing intermediaries through real deposits paying R_t^0. I consider the limit $\zeta \to 0$, where intermediary inside equity and consumption are negligible and the rest of the equilibrium is as in section 2.

The return of investing intermediaries is

$$R_{t+1}^L = R_t^0 + \frac{1}{\theta_t}\left(R_{t+1}^I - R_t^0\right),$$

where R_{t+1}^I is the sector return and $\frac{1}{\theta_t}$ is the leverage of the investing intermediaries, induced by the shock θ_t. Investing intermediary consumption at $t+1$ is $c_{t+1} = \zeta R_{t+1}^L$. Let $R_{t+1}^f = (1+i_t)P_t/P_{t+1}$ be the real return on risk-free bonds. For capital and risky bonds, $j \in \{k, b\}$, the investing intermediaries' first-order conditions imply

$$\mathbb{E}_t\left[\left(R_{t+1}^L\right)^{-\gamma^I}\left(R_{t+1}^j - R_{t+1}^f\right)\right] = 0,$$

while in section 2,

$$\mathbb{E}_t\left[\left(R^I_{t+1}\right)^{-\gamma_t}\left(R^j_{t+1}-R^f_{t+1}\right)\right]=0.$$

Denote log returns by lowercase. Since R^0_t is known at t, to a second-order approximation both conditions imply

$$\mathbb{E}_t\left[r^j_{t+1}-r^f_{t+1}\right]+\tfrac{1}{2}\left(\operatorname{Var}_t r^j_{t+1}-\operatorname{Var}_t r^f_{t+1}\right)=\gamma_t\operatorname{Cov}_t\left(r^I_{t+1},\, r^j_{t+1}-r^f_{t+1}\right),$$

with $\gamma_t=\gamma^I/\theta_t$. The AR(1) for γ_t then corresponds to $\theta_t=\gamma^I/\gamma_t$ for $\gamma_t\geq\gamma^I$.

A.5 Proofs

Consumption and savings are linear in wealth, so I set $\lambda^i=\lambda^d=1$ without loss of generality and read each household variable as a total for its type.

Proposition 4. *Let* $k^*_0\equiv\left(k_{-1}^{\chi^k}e^{(\frac{1}{2}-\gamma_0)\sigma_z^2}/(1+\bar{\imath})\right)^{1/(1-\alpha+\chi^k)}$ *and* $q^{k*}_0\equiv(k^*_0/k_{-1})^{\chi^k}$ *be the investment level and price of capital at which* $\omega^k=1$*, and suppose* $\gamma_0\sigma_z^2<-\mathbb{E}\log repay_1-\frac{1}{2}\sigma_b^2$*.*

(i) In any equilibrium in which debtors borrow, debtors hold no intermediary shares and investors do not borrow.

(ii) If $k^*_0\geq(1-\delta)k_{-1}$*, output and investment are positive in any equilibrium in which debtors borrow.*

(iii) If $k^*_0\geq(1-\delta)k_{-1}$*, an equilibrium in which debtors borrow,* $a^d_0<0$*, exists if and only if*

$$\bar{w}>\bar{w}^*\equiv(1+\bar{\imath})\,e^{-\mathbb{E}\log repay_1-\frac{1}{2}\sigma_b^2}\,\frac{(1-\alpha)\beta^d(1+\beta^i)}{\alpha\beta^i}\,q^{k*}_0\left(k^*_0-\frac{\beta^i}{1+\beta^i}(1-\delta)k_{-1}\right),$$

and it is unique.

Proof of proposition 4. (i) Households hold no risk-free bonds and issue but do not buy risky bonds, so $\omega^b\in[0,1)$, $\omega^k=1-\omega^b$ and, by (25), $\mathrm{rp}^k_0\leq\gamma_0\sigma_z^2$. By the definitions of the risk premia, and since $\mathrm{rp}^b_0\geq0$,

$$\frac{\mathbb{E}R^k_1}{R^{b,0}_1}=e^{\mathrm{rp}^k_0-\mathrm{rp}^b_0+\mathbb{E}\log\mathrm{repay}_1+\frac{1}{2}\sigma_b^2}<1.$$

Including the collection proceeds, the return on intermediary shares is $R^I_1+(R^{b,0}_1-R^b_1)\,\omega^b=\omega^kR^k_1+\omega^bR^{b,0}_1$, so its expectation is below $R^{b,0}_1$. A household of type j that holds shares and borrows sets $\mathbb{E}[M^j(\omega^kR^k_1+\omega^bR^{b,0}_1)]=R^{b,0}_1\,\mathbb{E}[M^j]=1$, where M^j is its stochastic discount

factor. Its consumption at $t = 1$ depends on the shocks only through R_1^k, and is increasing in it, so $\mathrm{Cov}(M^j, R_1^k) \leq 0$ and $\mathbb{E}[M^j(\omega^k R_1^k + \omega^b R_1^{b,0})] \leq \mathbb{E}[M^j]\,(\omega^k \mathbb{E}R_1^k + \omega^b R_1^{b,0}) < R_1^{b,0}\,\mathbb{E}[M^j]$, a contradiction. Investors save, so they do not borrow, and debtors borrow, so they hold no shares.

For (ii) and (iii), note that by (i), in an equilibrium where debtors borrow, bond market clearing requires the intermediary's portfolio share in the risky bond to be $\omega^b = -a_0^d/a_0^i$. Fix a candidate value $\omega^b \in [0, 1)$. By (24) and (25), $\mathrm{rp}_0^b = \gamma_0 \sigma_b^2 \omega^b$ and $\mathrm{rp}_0^k = \gamma_0 \sigma_z^2 (1 - \omega^b)$, so

$$Q_0^b = \frac{e^{\mathbb{E}\log \mathrm{repay}_1 + \frac{1}{2}\sigma_b^2 - \gamma_0 \sigma_b^2 \omega^b}}{1 + \bar{\imath}}, \qquad k_0 = k_0^*\, e^{\gamma_0 \sigma_z^2 \omega^b/(1-\alpha+\chi^k)}, \qquad q_0^k = (k_0/k_{-1})^{\chi^k}.$$

As ω^b rises, Q_0^b falls and k_0 and q_0^k rise.

Substituting the consumption policies (28)–(29) into goods market clearing, $y_0 = c_0^i + c_0^d + q_0^k(k_0 - (1-\delta)k_{-1})$,

$$(1 - \mathrm{mpc})\, y_0 = q_0^k (k_0 - (1 - \mathrm{mpc}^i)\,(1-\delta)k_{-1}) + \mathrm{mpc}^d\, Q_0^b \bar{w}. \tag{51}$$

Debtor savings at these prices are $a_0^d = (1-\alpha)y_0 - c_0^d = \frac{\beta^d}{1+\beta^d}(1-\alpha)y_0 - \frac{1}{1+\beta^d} Q_0^b \bar{w}$, so

$$-(1 - \mathrm{mpc})\, a_0^d = \frac{\alpha\beta^i}{(1+\beta^i)(1+\beta^d)}\, Q_0^b \bar{w} - (1-\alpha)\frac{\beta^d}{1+\beta^d}\, q_0^k (k_0 - \frac{\beta^i}{1+\beta^i}(1-\delta)k_{-1}). \tag{52}$$

At $\omega^b = 0$, (52) is positive if and only if $\bar{w} > \bar{w}^*$.

The candidate ω^b is an equilibrium if it equals the share implied by savings, $\omega^b = -a_0^d/a_0^i$. Asset market clearing gives $a_0^i = q_0^k k_0 - a_0^d$, so this condition is

$$-a_0^d = \frac{\omega^b}{1 - \omega^b}\, q_0^k k_0. \tag{53}$$

The left side is the borrowing debtors choose at the prices implied by ω^b; the right side is the borrowing the intermediary absorbs at portfolio share ω^b. An equilibrium in which debtors borrow is a solution to (53) with $\omega^b \in (0, 1)$.

(ii) In an equilibrium with $a_0^d < 0$, $a_0^i = q_0^k k_0 - a_0^d > 0$, so $\omega^b \in (0, 1)$ and $k_0 > k_0^* \geq (1-\delta)k_{-1}$, so $x_0 > 0$. Both terms in (51) are positive.

(iii) For $\omega^b \in [0, 1)$, $k_0 > \frac{\beta^i}{1+\beta^i}(1-\delta)k_{-1}$, so $q_0^k(k_0 - \frac{\beta^i}{1+\beta^i}(1-\delta)k_{-1})$ is the product of two positive increasing functions of ω^b. By (52), the left side of (53) is continuous and strictly decreasing in ω^b. The right side is zero at $\omega^b = 0$, strictly increasing, and diverges as $\omega^b \to 1$. A solution in $(0, 1)$ therefore exists if and only if the left side is positive at $\omega^b = 0$, that is, $\bar{w} > \bar{w}^*$, and it is unique. □

Proof of proposition 1. Multiplying both sides of the intermediary's portfolio share in bonds (24) by investor savings a_0^i and imposing bond market clearing, $\omega^b a_0^i = -a_0^d$, we get equation (26). Similarly, since the portfolio share in capital is $\omega^k = 1 - \omega^b$, multiplying both sides of the capital portfolio share (25) by investor savings and again using bond market clearing we get (27).

To see that both risk premia rise, note first that prices and investment depend only on the risk premia. By the definitions in (24) and (25), and (30),

$$Q_0^b = \frac{e^{\mathbb{E}\log \text{repay}_1 + \frac{1}{2}\sigma_b^2 - \text{rp}_0^b}}{1+\bar{i}}, \qquad k_0 = \left(\frac{k_{-1}^{\chi^k} e^{\frac{1}{2}\sigma_z^2 - \text{rp}_0^k}}{1+\bar{i}}\right)^{1/(1-\alpha+\chi^k)}, \qquad q_0^k = (k_0/k_{-1})^{\chi^k},$$

so Q_0^b is decreasing in rp_0^b. Both k_0 and q_0^k are decreasing in rp_0^k. By (52), borrowing $-a_0^d$ is therefore decreasing in rp_0^b. Borrowing is also increasing in rp_0^k, because $q_0^k(k_0 - \frac{\beta^i}{1+\beta^i}(1-\delta)k_{-1})$ is increasing in k_0 for $k_0 > \frac{\beta^i}{1+\beta^i}(1-\delta)k_{-1}$, and k_0 is decreasing in rp_0^k. Dividing each premium by its variance and summing,

$$\frac{\text{rp}_0^b}{\sigma_b^2} + \frac{\text{rp}_0^k}{\sigma_z^2} = \gamma_0. \tag{54}$$

Dividing one premium by the other and using asset market clearing, $a_0^i + a_0^d = q_0^k k_0$,

$$-a_0^d = \frac{\sigma_z^2 \,\text{rp}_0^b}{\sigma_b^2 \,\text{rp}_0^k}\, q_0^k k_0. \tag{55}$$

Risk aversion enters only (54). In (55), the left side is decreasing in rp_0^b and increasing in rp_0^k, as shown above. The right side is increasing in rp_0^b and decreasing in rp_0^k, since rp_0^k is in the denominator and $q_0^k k_0$ is decreasing in rp_0^k. So (55) makes rp_0^b a strictly increasing function of rp_0^k. The left side of (54) is strictly increasing in rp_0^k. A shock $\epsilon_0^\gamma > 0$ raises γ_0, so it raises both rp_0^k and rp_0^b. □

Proof of proposition 2. No agents hold capital after $t = 1$, so $k_1 = 0$, $q_1^k = 0$ and $R_1^k = \exp(\sigma_z \epsilon_1^z) k_0^{\alpha-1}/q_0^k$. Combining the definition of the capital risk premium with (30),

$$\text{rp}_0^k = \tfrac{1}{2}\sigma_z^2 - (1 - \alpha + \chi^k)\log k_0 + \chi^k \log k_{-1} - \log(1+\bar{i}),$$

and since $q_0^k = (k_0/k_{-1})^{\chi^k}$,

$$\frac{d\log q_0^k}{d\epsilon_0^\gamma} = \chi^k \frac{d\log k_0}{d\epsilon_0^\gamma} = -\frac{\chi^k}{1-\alpha+\chi^k}\frac{d\text{rp}_0^k}{d\epsilon_0^\gamma}. \tag{56}$$

Similarly, the bond risk premium is $\text{rp}_0^b = \mathbb{E}\log\text{repay}_1 + \frac{1}{2}\sigma_b^2 - \log Q_0^b - \log(1+\bar{i})$, so

$$\frac{d\log Q_0^b}{d\epsilon_0^\gamma} = -\frac{d\text{rp}_0^b}{d\epsilon_0^\gamma}. \tag{57}$$

Summing the consumption policies (28) and (29), substituting $w_0 l_0 = (1-\alpha)y_0$ and $\Pi_0 k_{-1}/P_0 = \alpha y_0$, and using goods market clearing, $y_0 = C + q_0^k x_0$,

$$(1-\text{mpc})\,C = \text{mpc}\,q_0^k x_0 + \text{mpc}^i\,(1-\delta)q_0^k k_{-1} + \text{mpc}^d\,Q_0^b\bar{w}.$$

Since $x_0 = k_0 - (1-\delta)k_{-1}$, (56) gives $d(q_0^k x_0) = q_0^k\left((1+\chi^k)k_0 - \chi^k(1-\delta)k_{-1}\right)d\log k_0$ and $dq_0^k = \chi^k q_0^k\,d\log k_0$. Differentiating with respect to the shock gives (31), and differentiating goods market clearing gives the response of output. □

Proof of proposition 3. Substituting $w_0 l_0^d = (1-\alpha)y_0$ and $\Pi_0 k_{-1}/P_0 = \alpha y_0$ into the consumption policies (28) and (29), $c_0^d = \frac{1}{1+\beta^d}\left((1-\alpha)y_0 + Q_0^b\bar{w}\right)$ and $c_0^i = \frac{1}{1+\beta^i}\left(\alpha y_0 + (1-\delta)q_0^k k_{-1}\right)$. Differentiating the logs,

$$\frac{d\log c_0^d}{d\epsilon_0^\gamma} = (1-\theta^b)\frac{d\log y_0}{d\epsilon_0^\gamma} + \theta^b\frac{d\log Q_0^b}{d\epsilon_0^\gamma},$$
$$\frac{d\log c_0^i}{d\epsilon_0^\gamma} = (1-\theta^k)\frac{d\log y_0}{d\epsilon_0^\gamma} + \theta^k\frac{d\log q_0^k}{d\epsilon_0^\gamma}.$$

By proposition 2 and (56), $\mathcal{C}^b = \text{mpc}^d\,Q_0^b\bar{w}\,d\log Q_0^b/d\epsilon_0^\gamma$ and $\mathcal{C}^k = \text{mpc}^i\,(1-\delta)q_0^k k_{-1}\,d\log q_0^k/d\epsilon_0^\gamma$, so dividing by c_0^d and c_0^i gives $\theta^b\,d\log Q_0^b/d\epsilon_0^\gamma = \mathcal{C}^b/c_0^d$ and $\theta^k\,d\log q_0^k/d\epsilon_0^\gamma = \mathcal{C}^k/c_0^i$, which gives (33) and (34). Differentiating the log of (32) gives (35). Subtracting (35) from (33) and (34) gives (36), and the bounds follow from $\theta^b, \theta^k \in (0,1)$. □

B Empirical appendix

B.1 Additional empirical impulse responses

Figure 12 shows the impulse responses of the current account and GDP to a one-standard-deviation fall in the excess bond premium, each measured as a percentage of trend GDP. Following a fall in the excess bond premium, the current account falls as foreign savings flow into the economy to finance the increase in both consumption and investment. After four quarters, the current account falls by around 0.2 percent of trend GDP, most of the 0.3 percent increase in GDP.

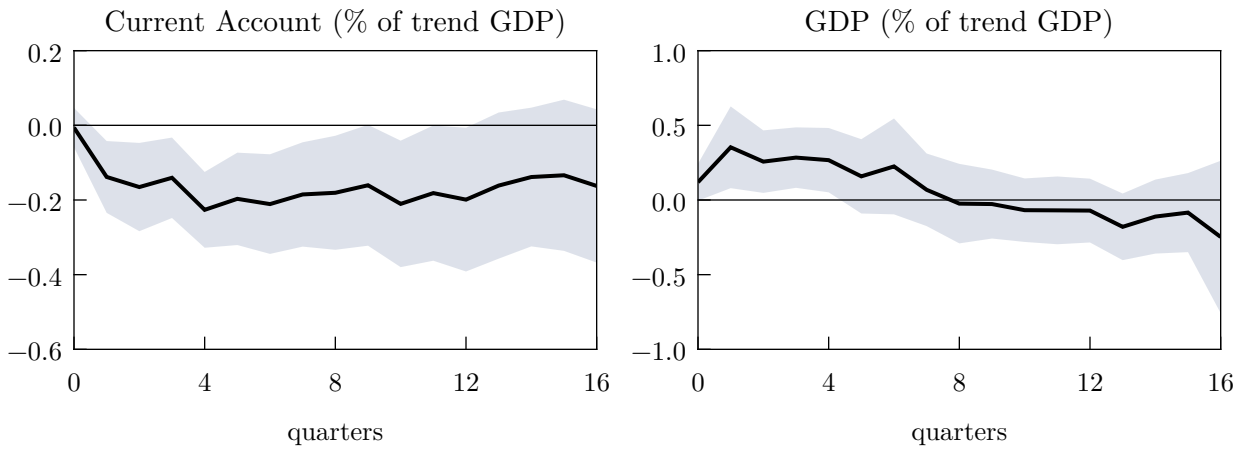


Figure 12: Impulse responses of the current account and GDP to a fall in the EBP

Notes: Impulse responses estimated by local projection as described in equation (37). The shock is a one-standard-deviation fall in the Gilchrist and Zakrajšek (2012) excess bond premium. The current account is measured as the ratio of the current account to trend GDP. GDP is measured as the ratio of GDP to trend GDP. Shaded bands are 95 percent confidence intervals based on heteroskedasticity-robust standard errors (Montiel Olea and Plagborg-Møller (2021)).

B.2 CEX data construction

This appendix provides further detail on the Consumer Expenditure Survey data used in section 4.2.

Consumption Nondurable goods are the sum of food, alcohol, tobacco, gasoline, apparel, reading and personal care. Services are utilities, household operations, vehicle operating costs, fees and admissions, health, miscellaneous, and television, radio and sound equipment. Durables are new and used vehicle purchases, other vehicles, household furnishings and equipment, and entertainment durables. The three categories are deflated by the corresponding CPI for nondurable goods, services (excluding rent of shelter) and durables.

Balance sheet data A household is a securities holder if it reports a positive value of stocks, bonds or mutual funds, any purchase or sale of securities, or a change in the value of securities held over the year. A household holds a mortgage if it reports positive mortgage interest paid or reports having home equity debt. A household has credit card debt if it reports finance charges on card accounts or store installment accounts or if it reports a credit card balance larger than one month of nondurables and services consumption. A household has an auto loan if it reports holding a vehicle loan or paying vehicle finance charges. A household has a personal loan if it has finance charges from a bank, credit union, finance company or other financial institution. From 2013 onward, personal loans are

grouped together with medical debt and other debt. For consistency, I also include medical debt in my measure of consumer credit before 2013. A household has medical debt if it reports finance charges or a balance owed to doctors, dentists, hospitals or other providers. I say that a household has consumer credit if it has credit card debt, auto loan debt, personal loan debt or medical debt. Table 12 shows the size of each group in the CEX data.

	Households	Months	Households per month	Mean share (%)
Cons. credit & securities	13,103	375	35	10.5
Cons. credit, no securities	59,109	375	158	47.9
Securities, no cons. credit	7,010	375	19	5.9
Neither	43,185	375	115	35.7

Table 12: Groups of households in the CEX

Sample selection I drop any interviews with missing or nonpositive nondurables and services consumption. I drop households where the reference person's age rises by more than one year or falls, or where the family size changes by more than three members. In order to calculate semiannual consumption growth, only households with all four interviews are kept. I drop households who do not report whether they have consumer credit borrowing. Finally, I exclude observations in the top and bottom one percent of semiannual nondurable consumption growth and total consumption growth.

Linking households across identifier changes In the first quarters of 1996 and 2005, some or all of the household identifiers change between interviews so that households cannot be directly linked across interviews. In these months, I match households to previous interviews based on the characteristics listed in table 13. In two adjacent interviews, each household is compared with the households in the other interview in the same region and urban status and with the appropriate interview number, and a candidate match is the household that it most closely resembles. Households are then linked if they are each identified as the best candidate match for each other and they share common values for at least 80 percent of the variables observed for both households. Households who are not renumbered provide a way to validate this matching procedure. The matching rule correctly identifies households in 97.2 percent of cases, and leads to false positives in only 0.05 percent of links.

B.3 Alternative specifications

In this section I consider a number of alternative specifications of the CEX regressions.

Category	Variables
Dwelling	Type of building, rooms, bedrooms, bathrooms, heating fuel, water-heating fuel, parking, year built, stories, air conditioning, apartment in structure, housing tenure, number of vehicles
Location	Population size of the PSU, MSA status, state
Reference person and family	Age of the reference person (within one year), sex, race, education, marital status, occupation, class of worker, family type, principal earner, composition of earners, number of earners, members under 18, member roster (sex, relation and age of each member)

Table 13: Variables used to link across identifier changes

Bekaert, Engstrom, and Xu (2022) risk aversion index Table 14 replaces the excess bond premium with the Bekaert, Engstrom, and Xu (2022) risk aversion index, which is estimated as a latent state based on a structural asset-pricing model. The estimation uses data on equity returns and variance, bond spreads and variance, and industrial production. The consumer credit groups again have negative and significant coefficients in columns (1) and (2), although these regressions also show negative and significant coefficients for the securities group.

	Nondurables and services		Food
	(1)	(2)	(3)
Risk aversion	-0.012 (0.040)	—	-0.100** (0.040)
Sec., no cons. credit × Risk aversion	-0.085** (0.039)	-0.070* (0.040)	-0.039 (0.059)
Cons. credit, no sec. × Risk aversion	-0.076*** (0.021)	-0.062** (0.024)	-0.084*** (0.024)
Cons. credit & sec. × Risk aversion	-0.118** (0.046)	-0.111*** (0.038)	-0.055 (0.065)
Fixed effects	None	Demog. × date	None
Observations	122,407	122,407	122,407

Table 14: Consumption growth and risk aversion, by household position

Notes: The same specifications as in table 1, with the Bekaert, Engstrom, and Xu (2022) risk aversion index in place of the excess bond premium.
* p<0.1, ** p<0.05, *** p<0.01.

The excess CAPE yield Table 15 replaces the excess bond premium with the excess CAPE yield: the inverse of the Campbell and Shiller (1988) cyclically adjusted price-to-earnings ratio less the ten-year Treasury yield net of a ten-year trailing average of CPI inflation. The ranking of the baseline is again reproduced. Households with consumer credit and no securities have the only statistically significant estimate in both columns (1) and (2).

	Nondurables and services		Food
	(1)	(2)	(3)
Excess CAPE yield	-0.132 (0.553)	—	-2.090*** (0.756)
Sec., no cons. credit × Excess CAPE yield	-0.522 (0.928)	-0.354 (0.856)	0.579 (1.325)
Cons. credit, no sec. × Excess CAPE yield	-1.365** (0.528)	-1.220** (0.535)	-0.721 (0.528)
Cons. credit & sec. × Excess CAPE yield	-1.236 (0.906)	-1.173 (0.844)	-0.079 (1.124)
Fixed effects	None	Demog. × date	None
Observations	122,407	122,407	122,407

Table 15: Consumption growth and the excess CAPE yield, by household position

Notes: The same specifications as in table 1, with the excess CAPE yield in place of the excess bond premium. * p<0.1, ** p<0.05, *** p<0.01.

Excluding recessions and Covid Table 16 drops NBER recession months and all months from 2020–21 from the estimation. Most of the identifying variation in the excess bond premium is in the recession episodes, so precision drops markedly. The consumer credit and no securities interaction is still negative, although not significant. Including the occupation, income quintile, age group, education, race and sex by time fixed effects restores significance for the consumer credit, no securities group at the five percent level for total consumption and the ten percent level for nondurables and services.

C Quantitative appendix

C.1 Solution algorithm

This appendix describes the numerical solution method. I first write the equilibrium conditions in stationary form and then describe the algorithm.

	Consumption			Nondurables and services		
	Full (1)	Excl. rec., 2020–21 (2)	Excl. rec., 2020–21 (3)	Full (4)	Excl. rec., 2020–21 (5)	Excl. rec., 2020–21 (6)
EBP	-0.137 (0.904)	0.625 (2.032)	—	0.225 (0.774)	0.818 (1.603)	—
Sec., no cons. credit × EBP	-0.454 (1.968)	4.671 (3.623)	2.883 (4.558)	-1.001 (0.901)	1.549 (1.422)	0.978 (1.302)
Cons. credit, no sec. × EBP	-2.207*** (0.763)	-2.882 (1.905)	-4.805** (2.167)	-1.746*** (0.515)	-1.015 (1.066)	-1.716* (1.005)
Cons. credit & sec. × EBP	-6.860*** (1.790)	-3.889 (3.371)	-5.703 (4.161)	-2.084 (1.271)	0.399 (1.399)	-0.622 (1.193)
Fixed effects	None	None	Demog. × date	None	None	Demog. × date

Table 16: Excluding NBER recession months and Covid

Notes: Columns (1) and (2) of table 2 and table 1, re-estimated after dropping NBER recession months and 2020–21. Columns (1) and (4) are the full-sample baselines, columns (2) and (5) drop the recessions and Covid, columns (3) and (6) add occupation, income quintile, age group, education, race and sex × time fixed effects.
* p<0.1, ** p<0.05, *** p<0.01.

Equilibrium conditions Denote rescaled variables as $\tilde{w}_t \equiv w_t/\exp(z_t)$, $\tilde{y}_t \equiv y_t/\exp(z_t)$, $\tilde{k}_t \equiv k_t/\exp(z_t)$, $\tilde{c}^j_t \equiv c^j_t/\exp(z_t)$, $\tilde{f}^j_t \equiv f^j_t/\exp(z_t)$, $\tilde{q}^{n,j}_t \equiv q^{n,j}_t/\exp(z_t)$, $\tilde{k}^j_t \equiv k^j_t/\exp(z_t)$, $\tilde{b}^j_t \equiv b^j_t/\exp(z_t)$, $\tilde{s}^j_t \equiv s^j_t/\exp(z_t)$. Denote $\Delta z_t \equiv z_t - z_{t-1}$.

The firm's optimality conditions and the price of capital (12) are

$$\tilde{y}_t = l_t^{1-\alpha}\left(\tilde{k}_{t-1}e^{\varphi_t-\Delta z_t}\right)^{\alpha}, \tag{58}$$

$$\tilde{w}_t = (1-\alpha)\frac{\tilde{y}_t}{l_t}, \tag{59}$$

$$\frac{\Pi_t}{P_t} = \alpha\frac{\tilde{y}_t}{\tilde{k}_{t-1}e^{\varphi_t-\Delta z_t}}, \tag{60}$$

$$q^k_t = \left(\frac{\tilde{k}_t}{\tilde{k}_{t-1}e^{\varphi_t-\Delta z_t}}\right)^{\chi^k}, \tag{61}$$

and the union's labor allocation is $l^j_t = \bar{l}^j l_t/\lambda^j$. The real return on capital is

$$R^k_{t+1} = e^{\varphi_{t+1}}\frac{\Pi_{t+1}/P_{t+1} + (1-\delta)q^k_{t+1}}{q^k_t}. \tag{62}$$

Financial wealth is each type's share of the payoff on the capital stock,

$$\tilde{f}^j_t = \frac{\eta^j_t}{\lambda^j}\left(\frac{\Pi_t}{P_t} + (1-\delta)q^k_t\right)\tilde{k}_{t-1}e^{\varphi_t-\Delta z_t}, \qquad \eta^i_t = \eta_t,\ \eta^d_t = 1-\eta_t. \tag{63}$$

In equilibrium, investors save only through intermediary shares, $\tilde{s}^i_t = \tilde{f}^i_t + \tilde{w}_t l^i_t - \tilde{c}^i_t$, and their capital constraint (8) is slack. The debtor's capital constraint (8) binds, $q^k_t\tilde{k}^d_t = \bar{k}\left(\tilde{f}^d_t + \tilde{q}^{n,d}_t\right)$, and the debtor borrows $q^b_t\tilde{b}^d_t = \tilde{f}^d_t + \tilde{w}_t l^d_t - \tilde{c}^d_t - q^k_t\tilde{k}^d_t$.[12] The portfolio returns

[12]For numerical stability, the code smooths the debtor's marginal return from $R^{b,0}_{t+1}$ to R^I_{t+1} with a logistic

are $R^i_{t+1} = R^I_{t+1}$ and

$$R^d_{t+1} = \frac{q^k_t \tilde{k}^d_t R^k_{t+1} + q^b_t \tilde{b}^d_t R^{b,0}_{t+1}}{\tilde{f}^d_t + \tilde{w}_t l^d_t - \tilde{c}^d_t}, \tag{64}$$

with $R^{b,0}_{t+1}$ given by (4). With $s^d_t = b^i_t = k^i_t = 0$, the market clearing conditions (19)–(21) give the intermediary's portfolio and the capital stock,

$$\omega^b_t = -\frac{\lambda^d q^b_t \tilde{b}^d_t}{\lambda^i \tilde{s}^i_t}, \qquad \omega^k_t = 1 - \omega^b_t, \qquad q^k_t \tilde{k}_t = \lambda^d q^k_t \tilde{k}^d_t + \omega^k_t \lambda^i \tilde{s}^i_t. \tag{65}$$

The intermediary's optimality conditions are

$$\mathbb{E}_t \left[\left(R^I_{t+1} \right)^{-\gamma_t} \left(R^k_{t+1} - R^f_{t+1} \right) \right] = 0, \tag{66}$$

$$\mathbb{E}_t \left[\left(R^I_{t+1} \right)^{-\gamma_t} \left(R^b_{t+1} - R^f_{t+1} \right) \right] = 0. \tag{67}$$

Given the aggregate state, household policies are homogeneous of degree one in own wealth $f^j_t + q^{n,j}_t$ and hours are set by the union, so the normalized marginal utility

$$\hat{u}^j_t \equiv \frac{du(\tilde{c}^j_t, l^j_t)}{dc} \left(\tilde{f}^j_t + \tilde{q}^{n,j}_t \right)^{1/\psi} \tag{68}$$

depends on the aggregate state only. The stochastic discount factor is

$$M^j_{t+1} = \beta^j \frac{\hat{u}^j_{t+1} \left[\left(\tilde{f}^j_t + \tilde{w}_t l^j_t - \tilde{c}^j_t \right) R^j_{t+1} + \tilde{T}^j_{t+1} + e^{\Delta z_{t+1}} \tilde{q}^{n,j}_{t+1} \right]^{-1/\psi}}{du(\tilde{c}^j_t, l^j_t)/dc}, \tag{69}$$

where $\tilde{T}^i_{t+1} = \left(R^{b,0}_{t+1} - R^b_{t+1} \right) \omega^b_t \tilde{s}^i_t$ is the investor's share of the proceeds of debt collection and $\tilde{T}^d_{t+1} = 0$. The household's Euler equation and human wealth are

$$\mathbb{E}_t \left[M^j_{t+1} R^j_{t+1} \right] = 1, \tag{70}$$

$$\tilde{q}^{n,j}_t = \tilde{w}_t l^j_t + \mathbb{E}_t \left[M^j_{t+1} e^{\Delta z_{t+1}} \tilde{q}^{n,j}_{t+1} \right]. \tag{71}$$

The wage satisfies the wage Phillips curve (46), inflation satisfies the Taylor rule (15) and the investor wealth share satisfies the law of motion (16). The exogenous states follow $\Delta z_{t+1} = \sigma_z \epsilon^z_{t+1} + \varphi_{t+1}$ and the AR(1) for γ_t.

weight in the ratio of debt to capital. The weight is close to one on the bond at all points of the ergodic distribution.

The economy has four state variables,

$$S_t \equiv \left\{ \eta_t,\ \tilde{w}_{t-1} e^{\varphi_t - \Delta z_t},\ \tilde{k}_{t-1} e^{\varphi_t - \Delta z_t},\ \gamma_t \right\}.$$

Computational algorithm I solve the model on a four-dimensional Smolyak grid (Judd, Maliar, Maliar, and Valero (2014)). Expectations are weighted sums over Gauss–Hermite nodes for ϵ^z_{t+1} and ϵ^γ_{t+1}, with probability $1 - p^d$, plus one disaster node with probability p^d, at which both innovations are zero, $\varphi_{t+1} = \varphi^z$ and $\text{repay}_{t+1} = 1 - \varphi^b$. Each grid point and node implies a state at $t+1$, at which I evaluate variables by Chebyshev interpolation.

The algorithm starts from a guess, based on the deterministic steady state, for $\{\hat{u}^j, \tilde{q}^{n,j}\}$, policies $\{\tilde{c}^j, l, \omega^b\}$, prices $\{q^k, q^b, i, \tilde{w}, P/P_{-1}\}$ on each grid point, and the state transitions for each node. Each iteration fits Chebyshev coefficients to $\{\hat{u}^j, \tilde{q}^{n,j}, l, q^k, P/P_{-1}\}$ on the grid and evaluates them at the $t+1$ state for each node. Taking these values as given, it performs the following steps at each grid point:

1. Given $\tilde{k}_t$, calculate $\tilde{y}_{t+1}$ and Π_{t+1}/P_{t+1} from (58) and (60), and the return on capital (62). Calculate financial wealth (63) and the returns R^f_{t+1}, R^b_{t+1} and $R^{b,0}_{t+1}$ from i_t, q^b_t and interpolated inflation.

2. Taking the portfolio shares, returns and stochastic discount factor as given, solve the Euler equation (70) for each household's consumption $\tilde{c}^j_t$.

3. Calculate savings, the debtor's capital holding and borrowing, the intermediary's portfolio and capital $\tilde{k}_t$ from (65), and the implied price of capital from (61).

4. Update the stochastic discount factors (69) and the intermediary return R^I_{t+1}. Solve (66) for the nominal rate i_t and (67) for the bond price q^b_t. Calculate inflation P_t/P_{t-1} from the Taylor rule (15), human wealth from (71) and normalized marginal utility from (68).

5. Solve the wage Phillips curve (46) for $\tilde{w}_t$, with hours l_t from (58) and (59).

6. Calculate the state transitions: η_{t+1} from (16), the lagged wage and capital, and γ_{t+1} from its AR(1).

Update guesses with damping. Repeat steps 1 to 6 until the differences in all variables are below tolerance. Investment then follows from the law of motion for capital (11), and the goods market clears by Walras' law.

Description	Value	Moment	Target	Model
β^i: discount factor	0.985	4E[risk-free rate]	0.7%	0.7%
γ: intermediary risk aversion	34.473	4E[eq. prem.]	7.9%	7.9%
$\bar{i}$: monetary policy intercept	0.002	4E[infl.]	0.0%	0.0%
σ_z: productivity volatility	0.004	$\sigma(\Delta \log l)/\sigma(\Delta \log y)$	1.2	1.2
ψ: IES	0.680	$\sigma(\Delta \log x)$	1.8%	1.8%
σ_γ: intermediary risk aversion vol.	2.030	$\sigma(\Delta \log c)$	0.6%	0.6%

Table 17: Calibrated parameters: capital-only model

Notes: Model moments are computed by simulating the model without disasters for 2000 periods from the stochastic steady state, discarding the first 100 periods, and averaging across 5000 simulations. Data moments are computed from 1994Q1 to 2025Q1 or taken from the literature. Second moments drop 2020Q2 and 2020Q3.

C.2 Capital-only model calibration

In the capital-only model, I take the limits $\lambda^d \to 0$, $\bar{l}^d \to 0$ and $\bar{\eta} \to 1$. I leave the other externally set parameters unchanged. I then calibrate the remaining parameters to match the same set of moments as in the baseline model, as described in table 17.

C.3 Model comparison regressions

Table 18 reports the empirical estimates used for model validation in table 9. I re-estimate equation (39) with overlapping dummies for securities and consumer credit, weighting each household by its share of nondurables and services consumption at the start of the growth window. Weighting arithmetic growth rates recovers the group aggregate, the relevant comparison for the model. The level used in the comparison is the interaction coefficient plus the EBP coefficient, so -2.3 for debtors and -1.1 for investors. For aggregate nondurables and services consumption in the national accounts, excluding housing and education, the estimate is -2.4.

C.4 Consumption decomposition

For each simulation in the consumption decomposition in section 5.3.2, I decompose the change in each household type's consumption and assign each term to four categories: the effect on incomes, the effect on the debtors' wealth, the effect on the investors' wealth and a residual. The decomposition is centered around the households' consumption policy

	Nondurables and services
Sec.	-1.140 (1.235)
Consumer credit	-2.292*** (0.853)
Neither	-0.930 (1.210)
Aggregate PCE	-2.429** (1.115)
Observations	122,407

Table 18: Spending-weighted consumption growth and the excess bond premium

Notes: Estimates of equation (39) with two overlapping dummies, one for holding securities and one for holding consumer credit, each interacted with the six-month mean of the Gilchrist and Zakrajšek (2012) excess bond premium and its six-month lag. Each row is the response to the excess bond premium of households holding only securities, only consumer credit, or neither: the excess bond premium coefficient plus the relevant interaction, with standard errors for the sum. Households are weighted by their CEX sampling weight times real nondurable consumption in the first half of the growth window, normalized to sum to one in each interview month. The dependent variable is the annualized semiannual percentage change in real nondurable goods and services consumption. Each regression also includes month-of-year dummies. Standard errors, in parentheses, are Driscoll and Kraay (1998) standard errors at an eleven-month lag length. Aggregate PCE is the same regression without the household dummies, for real per capita personal consumption expenditures on the same goods and services over the same months, with Newey–West standard errors at an eleven-month lag length.
* p<0.1, ** p<0.05, *** p<0.01.

functions. Household policies are homogeneous of degree one in wealth, so

$$c_t^j = \mu_t^j \left(f_t^j + q_t^{n,j} \right),$$

where f_t^j is financial wealth, $q_t^{n,j}$ is human wealth and μ_t^j is the state-dependent marginal propensity to consume out of wealth. At each simulation draw, taking the difference in consumption between the shocked and baseline path, we get

$$\Delta c_t^j = \bar{\mu}_t^j \Delta f_t^j + \bar{\mu}_t^j \Delta q_t^{n,j} + (\bar{f}_t^j + \bar{q}_t^{n,j}) \Delta \mu_t^j,$$

where $\bar{\mu}_t^j$, $\bar{f}_t^j$ and $\bar{q}_t^{n,j}$ denote the average between the shocked path and baseline path.

Financial wealth Financial wealth is type j's share of the payoff on the capital stock,

$$f_t^j = \frac{\eta_t^j k_{t-1}}{\lambda^j} \cdot \frac{\Pi_t + (1-\delta) Q_t^k}{P_t}, \qquad \eta_t^i = \eta_t, \ \eta_t^d = 1 - \eta_t.$$

The change in financial wealth Δf_t^j can be split into the change in dividends, prices and quantities,

$$\Delta f_t^j = \frac{1}{\lambda^j}\Big[\underbrace{\overline{\eta_t^j k_{t-1}}\,\Delta\frac{\Pi_t}{P_t}}_{\text{dividends}} + \underbrace{\overline{\eta_t^j k_{t-1}}\,(1-\delta)\Delta\frac{Q_t^k}{P_t}}_{\text{capital prices}} + \underbrace{\frac{\overline{\Pi_t + (1-\delta)Q_t^k}}{P_t}\,\Delta\left(\eta_t^j k_{t-1}\right)}_{\text{capital holdings}}\Big]. \tag{72}$$

Dividends are assigned to the income channel, while capital prices and holdings are assigned to the wealth channels.

Human wealth Human wealth is the price of a claim to labor income,

$$q_t^{n,j} = w_t l_t^j + \mathbb{E}_t\left[M_{t+1}^j q_{t+1}^{n,j}\right],$$

where M_{t+1}^j is household j's stochastic discount factor. The ex-dividend price of the claim is $q_t^{n,j} - w_t l_t^j$ and the realized return on the claim is

$$R_{t+1}^{n,j} = \frac{q_{t+1}^{n,j}}{q_t^{n,j} - w_t l_t^j}.$$

Solving for $q_t^{n,j}$ and iterating forward,

$$q_t^{n,j} = w_t l_t^j + \sum_{s\geq 1}\frac{w_{t+s}l_{t+s}^j}{\prod_{u=1}^s R_{t+u}^{n,j}}.$$

Taking the difference between the shocked and baseline paths term by term, we can decompose the change in human wealth into the change in labor income and the change in discount rates on labor income,

$$\begin{aligned}\Delta q_t^{n,j} = &\underbrace{\Delta\left(w_t l_t^j\right) + \sum_{s\geq 1}\overline{\left(\prod_{u=1}^s R_{t+u}^{n,j}\right)^{-1}}\,\Delta\left(w_{t+s}l_{t+s}^j\right)}_{\text{labor income}} \\ &+ \underbrace{\sum_{s\geq 1}\overline{w_{t+s}l_{t+s}^j}\,\Delta\left(\prod_{u=1}^s R_{t+u}^{n,j}\right)^{-1}}_{\text{discounting of labor income}}.\end{aligned} \tag{73}$$

The change in labor income is assigned to the income channel, while the change in discounting is assigned to the wealth channels since it reflects changes in households' intertemporal pricing.

Propensities to consume out of wealth Next-period wealth is

$$\begin{aligned} f_{t+1}^j + q_{t+1}^{n,j} &= \left(f_t^j + w_t l_t^j - c_t^j\right) R_{t+1}^{f,j} + \left(q_t^{n,j} - w_t l_t^j\right) R_{t+1}^{n,j} \\ &= \left(f_t^j + q_t^{n,j} - c_t^j\right) R_{t+1}^{a,j}, \end{aligned}$$

where $R_{t+1}^{f,j}$ is the return on financial wealth and $R_{t+1}^{a,j}$ is the return on total wealth,

$$R_{t+1}^{a,j} = \omega_t^j R_{t+1}^{f,j} + \left(1 - \omega_t^j\right) R_{t+1}^{n,j}, \qquad \omega_t^j = \frac{f_t^j + w_t l_t^j - c_t^j}{f_t^j + q_t^{n,j} - c_t^j}.$$

Consumption at $t+1$ is

$$c_{t+1}^j = \mu_{t+1}^j \left(f_{t+1}^j + q_{t+1}^{n,j}\right) = \mu_{t+1}^j \left(\frac{1}{\mu_t^j} - 1\right) c_t^j R_{t+1}^{a,j}.$$

Solving for $1/\mu_t^j$ and iterating forward,

$$\frac{1}{\mu_t^j} = 1 + \sum_{s \geq 1} \prod_{u=1}^{s} \frac{c_{t+u}^j / c_{t+u-1}^j}{R_{t+u}^{a,j}}.$$

Using $\Delta x = (\Delta x / \Delta \log x) \, \Delta \log x$,

$$\Delta \frac{1}{\mu_t^j} = \sum_{s \geq 1} \frac{\Delta \prod_{u=1}^{s} \frac{c_{t+u}^j / c_{t+u-1}^j}{R_{t+u}^{a,j}}}{\Delta \log \prod_{u=1}^{s} \frac{c_{t+u}^j / c_{t+u-1}^j}{R_{t+u}^{a,j}}} \sum_{u=1}^{s} \Big[\underbrace{\Delta \log \frac{c_{t+u}^j}{c_{t+u-1}^j}}_{\text{consumption growth}} - \underbrace{\Delta \log R_{t+u}^{a,j}}_{\text{return on wealth}} \Big]. \tag{74}$$

The change in the propensity to consume is then

$$\Delta \mu_t^j = -\mu_t^{j,1} \mu_t^{j,0} \, \Delta \frac{1}{\mu_t^j},$$

where $\mu_t^{j,1}$ and $\mu_t^{j,0}$ are the propensities on the shocked and baseline paths. The change in the return on wealth is assigned to the wealth channels. The consumption growth decomposition comes from households' Euler equations, which satisfy

$$\beta^j \mathbb{E}_t \left[\left(\frac{c_{t+1}^j}{c_t^j} \right)^{-1/\psi} \left(\frac{\Phi(l_{t+1}^j)}{\Phi(l_t^j)} \right)^{1-1/\psi} R_{t+1}^j \right] = 1,$$

where R^j is household-type j's portfolio return. Log-linearizing and differencing across the two paths,

$$\Delta \log \frac{c^j_{t+1}}{c^j_t} \approx \underbrace{\psi \, \Delta \log \mathbb{E}_t R^j_{t+1}}_{\text{expected return}} + \underbrace{(\psi - 1) \, \Delta \log \frac{\Phi(l^j_{t+1})}{\Phi(l^j_t)}}_{\text{hours}} . \tag{75}$$

The change in expected returns is assigned to the wealth channels, while the change in hours is assigned to the income channel.